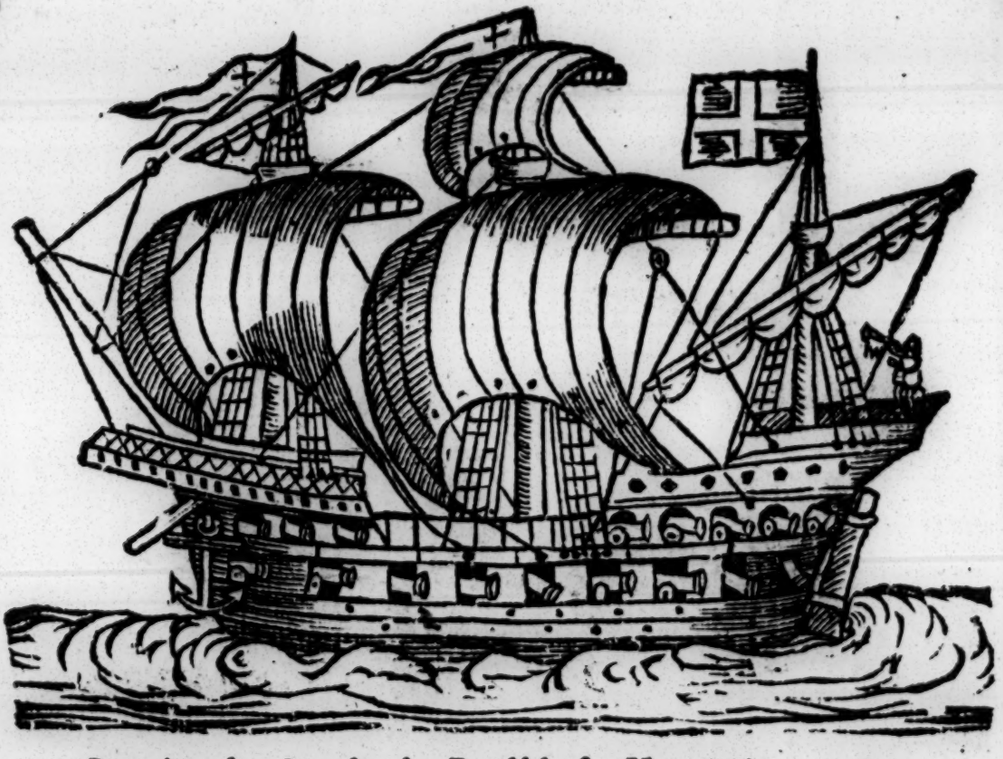
The new Attractiue.

Containing a Short Diſcourſe of the *Magnes* or Loadſtone: and amongſt other his vertues, of a new diſcouered ſecret and ſubtill propertie, concerning the Declining of the *Needle*, touched therewith vnder the plaine of *the Horizon*.

Now firſt found out by *Robert Norman* Hydrographer.

HEEREVNTO ARE ANNEXED CERtaine neceſſary rules for the Arte of Nauigation: by the ſame R. N.

Newly corrected and amended by M. W. B.



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TO THE RIGHT WORSHIPFVLL, M. WILLIAM *Borough* Eſquire, Comptroller of her Maieſties Naule: *Robert Norman* wiſheth increaſe of worſhip, in perfecte felicitie.

Rchimedes, after long ſearch made to find out the fraudulent mixture of King Hierons golden Crowne: could not by any means attain the ſecret thereof, till at length by chaunce as he was Bathing himſelf, he obſerued that ſtill as his body entred into the water, it forced the ſame to riſe and runne ouer the veſſell: whereupon the matter of the Crowne comming to his remembrance, and applying the manner of the water to his preſent purpoſe, he was foorthwith mooued with ſuch exceeding ioy, that he leapt ſodainlye out of the water, and forgetting himſelfe to be naked, came crying to the King his maſter, I haue found, I haue found: So I (right Worſhipfull, although in other reſpects & points of learning & knowledge, I will not preſume to compare with *Archimedes*, who is many wayes incomparable, nor with any other learned Mathematician, being my ſelfe an vnlearned Mathematician) by occaſion of my profeſsion, making ſundry experiments of the *Magnes* ſtone, found at length amongſt many other effectes, this ſtrange and newe propertie of Declining of the Needle: which forgetting, or rather neglecting mine owne nakednes and want of furniture to ſet forth the matter, I haue heere in ſimple ſorte propoſed and publiſhed to the viewe of the

world. Wherin I consider, though the occasions wer diuers, our cases are not vnlike. *Pithagoras* likewise that great Philosopher, for the singular ioy conceiued of the invention of that excellente Theoreme of Rectangle Triangles, made a solempne sacrifice, offring therein an Oxe vnto the Muses, as testifieth *Vitrunius* the author also of the former example. So that we se these men and sundrie other that are mentioned in authors, being caried and ouercome with the incredible delight conceiued of their owne deuices and inuentions, though they follow partly the peculiar contentatiō of their priuat fancies, yet they seme chiefly to respect ether the glory of god or the furtherance of some publike commoditie. Whose good example in this behalfe I will indeuer to follow, when to reach their rare giftes otherwise, is rather to be wished, then hoped for. And seeing it hath pleased God to make mee the instrument to open this noble secret, that his name might be glorified, and the commoditie of my Cuntry procured therby, I thought it my dutie to aduenture my credite, and make my name the obiect of slaunderous and carping tongues, rather then such a secrete should be concealed, and the vse thereof vnknowen.

How beneficiall the Art and exercise of Nauigation is to this Realme, there is no man so simple but sees, by meanes whereof wee being secluded and diuided from the rest of the world, are not withstanding as it wer Cittizens of the world, walking through euerie corner, and round about the same, and enioying all the commodities of the world. How necesarie the perfect knowledge of the Nedle or Compasse is, to the perfection of the Art of Nauigation, your selfe who haue long time verie industriously trauailed therein and therby in it, and other Sea causes excell others, can best iudge. To ataine vnto this perfection, and to frame, as it were, a Theorike, with *Hypotheses*, and rules for the saluing of the apparant irregularitie of the Variation (if it be a thing possible or with in the compasse of mans capacitie) it must doubtlesse be done by due obseruatiō of this new Declining propertie,

with the Variation cauſed by the admirable efficacie of the *Magnes* ſtone, Wherfore to further the noble ſtudie of Nauigation and Hydrographie, and to giue ocaſion to induſtrious & skilfull traualers by ſea & by land, to make diligẽt obſeruatiõ of theſe effects in ſundry places, wher by ſome generall concluſion may be inferred, I haue here ſet downe whatſoeuer I could finde by exact triall, and perfect experiments, & beſids this new property, diuers other rare effects that followe this Philoſophicall ſtone. Wherin although I may ſeeme to haue diſcouered my nakednes, and want of eloquence and orderly Methode to vtter my conceits withall, I truſt the reader will either of his curteſie take all things for good that is well ment, or of his grauitie not regarding the wordes but the matter, diſſemble my faults, and accept of my paines. And whereas amongſt diuerſe learned and expert men in the Mathematicall ſciences, to whom I haue imparted this ſecret, I haue firſt of all and chiefly from time to time ſhewed the manner of it to your Worſhip, which firſt gaue occaſion that I fell into the conſideration thereof, and through whoſe encouragement I entred into farther examination of the matter, which otherwiſe I had neglected: If my trauaile heerein take ſuch effect, that others be benifited or pleaſured therby, I haue my deſire, and they are to be thankfull vnto you for the ſame, for I muſt needes aſcribe the occaſion to your good counſaile. To you therfore as to the moſt worthie & beſt acquainted with the cauſe, I preſent the firſt ſight of this my rude and ſimple draught, which I truſt, acording to your accuſtomed curteſie and friendly affection towards me you will take in as good part, as it proceedes from a hartie good will towardes you, whom I praye God long to preſerue with all increaſe of Worſhip to his good pleaſure.

Your Worſhips moſt humble, Robert Norman.

To the Reader.

MAny and diuers ancient Authors, Philosophers & others, haue written of the Magnes or Loadstone, as also of his substance, vertue and operation, and thereupon setting downe their opinions and iudgements, haue leste the same as infallible truthes for them that shall succéde. And as I may not, nor meane not herein willingly to condemn the learned or ancient writers, that haue with great dilligence laboured to discouer the secrets of Nature in sundrie things, with their operations & causes: yet I meane God willing, without derogating from them, or exalting my selfe, to set downe a late experimented truth found in this stone, contrary to the opinions of all them that haue heretofore writtē therof. Wherein I meane not to vse barely, tedious coniectures or imaginations: but briefly as I may, to passe it ouer, grounding my Arguments onelye vpon experience, reason and demonstration, which are the grounds of Arts. And albeit, it may be said by the learned in the Mathematicalles, as hath béene alreadye written by some, that this is no question or matter for a Mechanitian or Mariner to meddle with, no more then is the finding of the longitude, for that it must be handled exquisitelye by Geometricall demonstration, and Arithmeticall Calculation: in which Artes, they would haue all Mechanicians and Sea-men to be ignorant, or at leaste insufficiently furnished to performe such a matter, alleadging againste them the latine Prouerbe

Prouerbe of Apelles, *Ne sutor vltra crepidam*: But I do verilye thinke, that notwithstanding the learned in those Sciences, being in their studies amongst their bookes, can imagine greate matters, and set downe their farre fetcht conceites, in faire showe, and with plawsible wordes wishing that all Mechanicians were such as for want of vtterance, should be forced to deliuer vnto them their knowledge and conceites, that they might flourish vppon them, and applye them at their pleasures: yet there are in this land, diuers Mechanicians, that in their seuerall faculties and professions, haue the vse of those Arts at their fingers endes, and can apply them to their seuerall purposes, as effectually and more readily then those that would most condemne them. For albeit they haue not the vse of the greek and Latin tongues, to searche the varietie of Authors in those Artes, yet haue they in English for Geometrie, Euclides Elements, with absolute demonstrations: and for Arithmaticke, Records workes, both his first and second part: and diuers others, both in English, & in other vulgar languages, that haue also written of them, which bookes are sufficient to the industreous Mechanician, to make him perfect and ready in those sciences, but especially to apply the same to the art and faculty which he chiefly professeth. And therefore I would wish the learned to vse modesty in publishing their conceits, and not disdainfully to condemne men that will search out the secrets of their artes and professions, and publish the same to the behoofe and vse of others, no more then they would that others should iudge of them, for promising much and performing little or nothing at all. Aristotle saith, that euery man is best to be beléeued in his owne professed Art and Science. Now (curteous reader) I am to request thée to accept of this my discourse, wherein I haue taken some paines (as the trauaile it selfe may testifie) and béen at some charge,

for

for the more careful and orderlie handling of such matters as are necessarilie incident to this presente treatise: All which I haue bene content to doe, that the worke (though it bee not big, yet effectuall) by the common vse thereof, may yéeld profit accordingly, to them specially that are of capacitie to comprehend this new reuealed secret. To conclude, the chiefest and onely marke whereat I lay leuell, was the benefiting of my Cuntrie-men, in whom I wish continuall increasse of knowledge and cunninge, as in all other commendable professions, so chieflie in those that are most necessarie and profitable. Thus bequeathing my trauaile héerein to thy discréete construction and wishing thy furtherance in this most necessarie and profitable knowledge,

I leaue thée to the direction of Gods holy Spirit.

Fare-well.

Robart Norman.

The *Magnes* or Loadſtones Challenge.

Giue place ye glittering ſparkes,
ye glimmering Diamonds bright,
Ye Rubies red, and Saphires braue,
wherein ye moſt delight.
In breefe, ye ſtones inricht,
and burniſht al with golde,
Set forth in Lapidaries ſhops,
for Iewells to be ſolde.
Giue place, giue place I ſaie,
your beautie, gleame, and gle,
Is all the vertue for the which,
accepted ſo you bee.
Magnes, the Loadſtone I,
your painted ſheaths defie,
Without my helpe in Iudian ſeas,
the beſt of you might lie.
I guide the Pilats courſe,
his helping hand I am,
The Mariner delights in me,
ſo doth the Marchant man.
My vertue lies vnknowen,
my ſecrets hidden are,
By me the Court and Common weale,
are pleaſured verie farre.
No ſhip could ſaile on Seas,
her courſe to runne aright,
Nor Compaſſe ſhew the readie waie,
were Magnes not of might.

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Blush then, and blemish all,
bequeath to me thats due,
Your seates in golde, your price in plate,
which Iewellers doo renue.
Its I, its I alone,
whom you vsurpe vpon,
Magnes my name, the Loadstone cald,
the prince of stones alone.
If this you can denie,
then seeme to make replie,
And let the painefull Sea-man iudge,
the which of vs doth lie.

The Mariners iudgement.

THE Loadstone is the stone,
the onelie stone alone,
Deseruing praise aboue the reft,
whose vertues are vnknown.

The Marchants verdict.

THe Diamõds bright, the Saphirs braue
are stones that beare the name,
But flatter not, and tell the troath,
Magnes deserues the fame.

The new Attractiue.

The first Chapter.

Of the Magnes or Loadstone, where they are found, and of their colours, weight, and vertue in drawing yron, or stele: & of other properties of the same stone.

THE Magnes or Loadstone is foũd in diuerse partes of the world, and most commonlie in Yron Mines, and althoughe it bee ponderous and weightie, yet it is not found to bee of the Yron Ewre, neither containeth in it anye mettall of it selfe, but hath a certaine affinitie vnto yron or steele. It was called Maones, because the first finder thereof was so named, who (as Plinie writeth) was an Herdsman in East India.

This stone (as writeth Cardinal Cusan) hath substance, vertue, & operation. His vertue is conserued & nourished of his substance: & of this vertue procedeth diuerse strange effects and operations, seruing to many good purposes, as specially in the art of Nauigation, without which there could haue been no discoueries by sea, nor the parts of the world made knowen & frequented, as now they are. And therefore the vertue of this Stone of all others, may bee accounted the most precious.

Of these are diuerse sortes differing each from other, as well in goodnesse, as in colour, weight, and force, but not in propertie (although manie haue iudged the variation of the Needle, to be according to the distaunce of the Yle where the stone was bred, to the place where he is vsed.)

The first and best sort of these stones com out of the East India, from the cost of China, and Bengalia, and is of the colour of yron or sanguine colour: these stones are verye massiue & waightie, & will draw or lift vp the iust weight of it selfe in yron or steele (if the stone exceede not a pound weight) And these are of the finest sort, and are sold commonly for their proper weight in siluer in the East India where they grow, because the best & finest are verie rare to be found. For it is comonly a sole stone, lying by himselfe in the earth, and no shell or peece of another.

The best lodstone

there is another sort of a reddish coulour found in Arabia and the red Sea, growing broad and flat, much like to a Tilestone or Slate: this is not so weightie as those of China, but it is verie neere as good, and the vertue continueth longe on the compasse or Needle that is touched with it.

Next the best.

There is likewise of these stones in Leuant, in the Ile of Elba, hard by a towne in the same Iland called Porto Feraro, from whence our Mariners dailie bring of them, and are called there Calamita Preta, that is to saie, The blacke Magnes, because there is another sort that is whit and light, like vnto a peece of dry Fullers claie, and is called Calamita Blanca.

This Calamita Blanca is founde alwaies with the other, sticking fast in the out side thereof like claie. And this white is forbidden to be vsed in that countrie, because euill women there, doe applie it to destroye conception, whereof this stone is a great enimie. Other things are noted of this white Calamita for obtaining of wanton purposes, which I thinke not credible, and therefore will omit it. These blacke stones of Elba are mingled with white vaines, they are of no great force, nor their vertue of long continuance.

Also there are of these stones in high Almanie, that are full of holes like a hunnie combe, & lighter then the other, but yet verie good, and these are of yron coulour.

Another

Another sort there is in Norwaie, in the yron Mines, as in Longsounde, and other places, their colour is blacke, mixed or as it were interlarded with graie, these are of the smallest force of anie that are found. The worst

I haue seene also in the Mines of Carauaca in Spaine of a graie colour, but of no great force: these are commonly brought by horse downe to Siuill and Caliz to bee sould, and oftentimes to Valentia, Alicante, and Lisbone.

All these stones are different one from another, as well in force as in colour and weight: yet all of one operation in the Nedle, shewing one point Attractiue, as I haue proued my selfe by three sundrie sortes of them, which I haue: and all drawing yron to them. Yet the Philosopher Auerroes writeth that ỹ Magnes draweth not yron vnto it, but the yron of his naturall inclination moueth to the Stone.

And though this position may seeme to carrie some truth with it, by the bare view of the sight, when the yron is lighter then the Stone: yet contrarie wise you shall finde, that the Stone will moue to the yron, if the Stone bee good, and the yron of greater weight then the stone (so that the weight of the Stone exceede not his Attractiue strength.)

Neuertheless, we may not thereby take awaie the vitall or liuelie spirit from the Stone, and attribute it vnto the yron: for in so doing we should doe Nature greate wrong. For it is apparant, that the yron hath no Attractiue vertue, nor power of it selfe, vntill it haue receiued it of the stone. But yron hauing a certaine affinitie, or naturall qualitie agreeable to the stone, doth aptly and freely receiue his vertue, and as a subiect, suffereth his vitall spirit of the stone to impresse, and rest quietly in his massiue and solide bodie, which when it hath receiued by touching the stone, it is indued with the verie same propertie and operation in all respects (though not in so greate force) as the stone it selfe. The vital and naturall spirite and operation of the Loadstone.

For as the Stone hath power to shew the Attractiue point, so hath the touched Yron. As the Stone hath two principall points, so hath the Yron. And likwise, as the stone hath power to drawe yron to it, so will the Yron so touched drawe another yron to it, and impart all these vertues to another yron in qualitie, though not in quantitie: and thus in all respects it conteineth in it, the verie propertie of the stone.

Paracelsus writing of the augmenting of the Strength of the Magnes Stone saith, that if this Stone be laide in the fire, vntill it bee almost redde hot, and then taken out and quenched in the Dile of Crocus Martis, it will so augment and multiplie his force, that it will pull a naile out of a wall. But I suppose he meant not that the naile shuld be fast, for then it were a miraculous matter.

Others haue written, that in those partes, where the Magnes groweth in the sea, it is of such force, that if anie shippes that haue yron in them passe by, or ouer them, that they are presentlie either staied, or drawen downe to the bottome by reason of the yron. Not these onelie, but many other Fables haue bene written by those of auncient time, that haue as it were set downe their owne imaginations for vndoubted truthes, and this most of all in Geographie & Hydrographie, or Nauigation. Therfore I wish experience to bee the leader of Writers in those artes, and reason their rule in seting it downe, that the followers bee not led by them into errours, as often times haue beene seene.

True it is, that God is mightie and meruailous in all his woorkes: yet he doth not allowe vs to saie more then truth of them. And truelie, his power is as greatlie shewed in the Magnes, as in anie Stone that he hath created: and who so shall goe about curiouslie to seeke out the efficient cause of his properties, I suppose the longer hee seeketh, the more hee shall meruaile, and yet neuer the neerer his purpose.

The vertue of this Stone is distributiue, as many other vertues are, much comparable vnto Muske, that hauing a sweete sauour or smell it selfe, imparteth the same to another thing, as to a paire of Gloues, and those Gloues giue out sauour, and parfume a whole chest of clothes: Euen so the yron that hath receiued this vertue of the stone, will extend, and giue the same to another, and that yron to another, and so to many.

And in this point the stone is meruailous, that notwithstanding you touch ten thousand yrons or nails with him euery one of them carrying away as much vertue as wil lift vp another his like (so they exceed not the weight of a fiue pennye naile) yet the stone it selfe will be nothing diminished of his strength, but continue of one force.

If I should say here, that by the Attractiue strength of a small Magnes of two or three pound weight, I could lift vppe, or cause to hange by the vertue thereof, a thousand pound of yron at one instant, peraduenture you would be doubtfull of the successe. Neuertheless by experience in all things, wherein consisteth truth and reason, of necessitie reason must yéeld, when truth is present. And therfore because you shall not remaine doubtfull héerein, thus you may doe it, and onely make proofe by two or three nailes, if you will: for the same successe that you haue in them, you shall haue in all the rest.

Take a common bord naile, & touch the head of it with the North parte of the Magnes or Loadstone, then take ỹ same naile and beate it with a péece of woode lightly into some post or timber vpwardes, so as the head maye hang downewardes, (but not with yron, because the yron will take awaie some part of the vertue from the naile:) this done, take another like naile, and touch the head ther of with the South parte of the Stone, and then if you put the head of it to the head of ỹ first naile, it wil hang fast by it a whole yere or more. And after this manner you may, if you will take ỹ paines, hang a hundred tun of yron with

the

the vertue of this litle stone, and yet the stone nothing diminished of his force. But it is necessarie in proofe of this matter, that you haue a verie good Stone.

Irons to hang one by another by vertue of this stone

Furthermore, concerning the other properties of this stone, if you put it in a drie dish, and set it to swimme in a tub of water, it will turne the dish about, and the North part of the stone, after many swarumgs to and fro, will rest, and directlie shew the line of Variation, or imagined Attractiue point.

Also, if you hang this stone by a thrid, that it may easilie moue, it will shew the like effect as on the water. And if you haue two stones, putting the two South partes of them together, the one will flie and turne awaie from the other, and likewise of the North points.

A speciall note.

And further ye shall note as a speciall point, that the North point of the stone touching a Needle, or the wyers of a Compasse, will make the same point touched to shew the South: and contrariwise, beeing touched with the South point, will make the same to shew the North. So as alwaies that part of the stone that answereth to the North of the needle, is properlie the South part of ỹ stone.

The second Chapter.

Of the diuerse opinions of those that haue written of the Attractiue point, and where they haue imagined it to be.

THE subtill properties and hid secrets of Nature in the Magnes, as also in diuerse other things, hath so troubled the wits of the searchers thereof, that alwaies when they came to the vpshot, wanting experience, & thereby reasons finger to shew them a direct mark, they were constrained to seek or imagine a marke, where in deede none at all was, and thus shooting

shotting as it were in ỹ aire, euerie man where he thought best, they haue all shot wide, and none touched the marke. The marke I meane heere, is the point Attractiue, or rather, as shall bee saide hereafter more at large, the point Respectiue.

This point, aunciently called the Attractiue point, hath been by some imagined to bee in the mouing spheeres distant from the poles of the world: which opinion Martin Curtes in his Booke of Nauigation refuting, saith, that if it were so, then the same point beeing carryed about the pole by their violent motion, would cause the Needle or Compasse touched with the vertue of the Stone, to varie dayly in euerie place, according to the diurinall motion of the same sphere. But in confuting that erronious opinion, he hath (as it appeareth) fallen into as great an error himselfe: imagining the point Attractiue to bee beyond the poles of the worlde, without all the moueable heauens. Which point (saith he) hath power by Attractiõ to draw yron to it, that is touched with the Loadstone. This errour I referre to be discussed in the first Chapter.

Others haue thought this point to be in the earth, neere the North pole, imagining in that part to bee some greate rocks of the Loadstone, & that by their Attraction the cõpasse or needle is caused to Respect or shew that part.

This opinion of all the rest is easiest to bee confuted by daily experience: for if the compasse or needle were drawn towardes the North part by any Attraction of the Magnes stones in those parts imagined, why then shoulde not not the Compasse or Needle shew the same effecte in mouing towards the Iland of Elba in the Leuant seas, where are great quantities of these Stones: and yet shippes sailing within a mile of this Iland, yea, and into Porto Feraro a Towne of the same Ile, within a quarter of a mile of a huge Rocke of these stones, the Compasse or needle is not found anie thing to be drawne or chaunged, nor the Attraction of this huge rocke to extend so farre as one

quarter of a mile. And as I haue said by this, so may I say by diuerse other places where the Loadstone are found, in Cliftes and Mines nere to the sea side, as in Norwaie and other places.

Pedro de Medina in his booke of Nauigation is of the opinion of Martin Curtes as touching the Attractiue point, but he doth not allowe of the variation of the compasse or needle, but saith, that if the cõpasse or needle shew not the pole, the fault is in placing the wiers on the flie, & not in anie propertie it hath to varie.

These opinions be diuerse, but the chiefest cause why they haue gone so farre wide from the Attractiue point, as I haue aboue sayd, was because they wanted reasons finger to shew them towardes the direct marke. By this reasons finger, I meane a certaine Declyning propertie vnder the Horizon, latelie found in the Needle, which I will entreate off at large.

The third Chapter.

By what meanes the rare and straunge Declyning of the Needle, from the plaine of the Horizon was first found.

HAuing made many and diuerse Cõpasses, and vsing alwaies to finish and end them, before I touched the Needle, I foũd continuallie that after I had touched the yrons with the Stone, that presentlie the North point thereof would bend or Decline downwards vnder the Horizon in some quantitie: insomuch that to the Flie of the Compasse, which before was made equall, I was still constrained to put some small peece of ware in the South part therof, to counterpoise this Declining, and to make it equall againe.

Which effect hauing many times passed my handes, without

without anie great regard thereunto, as ignorant of anie such propertie in the Stone, and not before hauing heard nor read of anie such matter: It chaunced at length that there came to my hands an Instrument to be made, with a Needle of fiue inches long, which Needle after I had polished, cut of a iust length, & made it to stand leuell vpon the pin, so that nothing rested but onelie the touching of it with the Stone: when I had touched the same, presentlie the North part therof Declined downe, in such sort, that beeing constrained to cut awaie some of that part, to make it equall againe, in the end I cut it too short, and so spoiled the Needle wherin I had taken so much paines.

Hereby beeing stroken into some cholar, I applyed my selfe to seeke further into this effect, and making certaine learned and expert men, my friendes, acquainted in this matter, they aduised me to frame some Instrument, to make some exact trial, how much the Needle touched with the Stone would Decline, or what greatest Angle it would make with the plaine of the Horizon, Whervpon I made diligent proues, the manner whereof is shewed in the Chapter following.

The fourth Chapter.

How to finde the greatest Declining of the Needle vnder the Horizon.

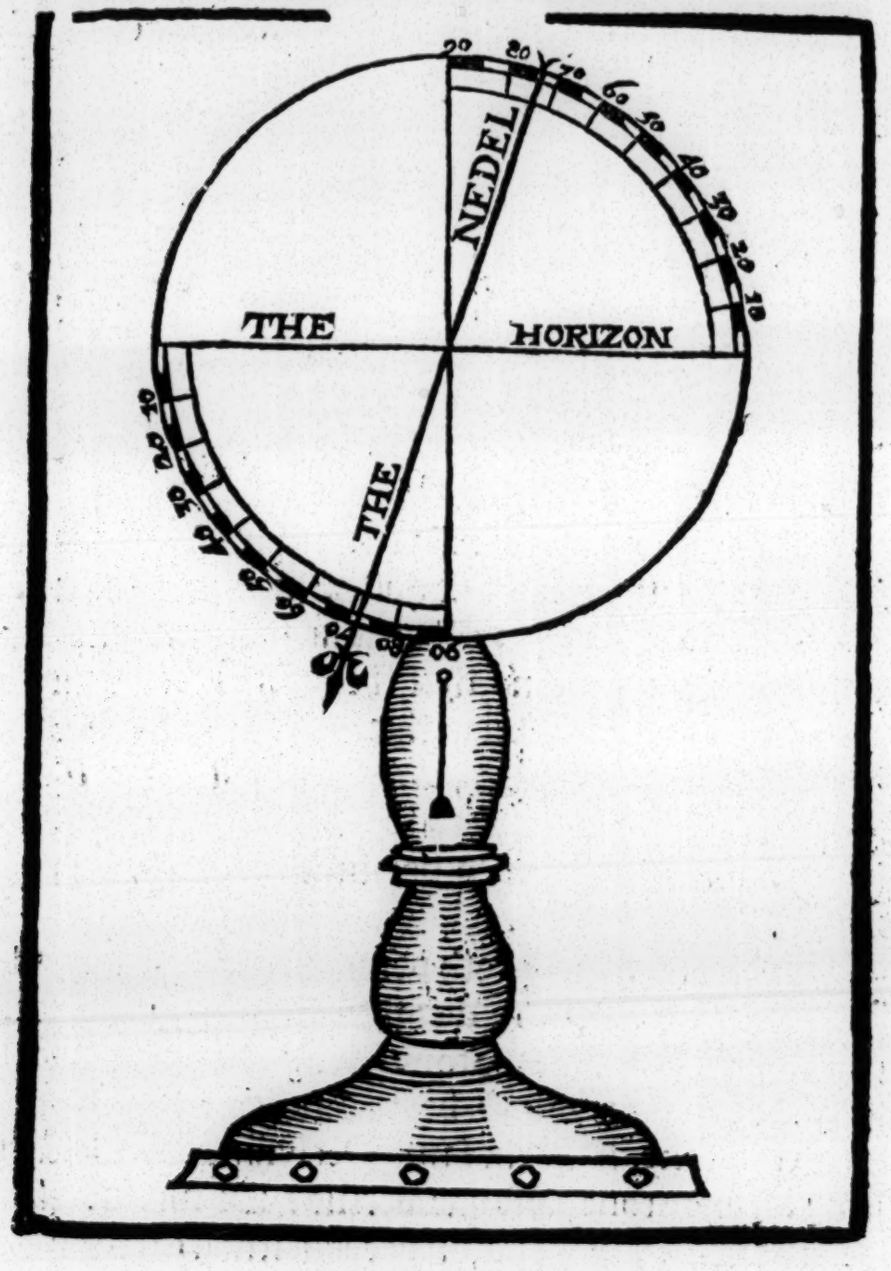
TAke a small Needle of Steele wier of fiue or sixe inches long, the smaller and the finer mettall, the better: and in the middle thereof (crosse ỹ same) by the best meanes you can, fixe as it were a small Axeltree of yron or brasse, of an inch long, or thereabout, and make the ends therof verie sharpe whereupon the Needle may hang leuell, and plaie at his pleasure. Then prouide a round plaine Instrument like an Astro-

lobe, to be diuided exactly into 160. partes, whose diameter must bée the length of the Néedle, or thereabout, and the same Instrument to bée placed vppon a foote of conuenient heyght, with a plumme lyne to set it perpendicular.

Then in the Centre of the same Instrument, place a péece of Glasse hollowed, and against the same Centre vppon some place of Brasse that may bée fixed vpon the foote of the Instrument, fit another péece of Glasse, in such sorte that the sharpe endes of the Axeltrée béeing borne in these two Glasses, the Néedle may play fréely at his pleasure, according to the standing of the Instrument.

And the Néedle must be so perfected, that it may hang vpon his Axeltrée both endes leuell with the Horizon, or béeing turned may stande and remaine at anie place that it shall bée set: which béeing done, touch the saide Néedle with the Magnes stone, and set the Instrument perpendicular by the plumme lyne, and turne the edge of the Instrument South and North, so as the Néedle may stande duely according to the Variation of the place: which Variation the Néedle of his owne propertie woulde shewe, were it not that hée is constrained to the contrarie by the Axeltrée.

Then shall you sée the Declination of the North point of the touched Néedle, which for this Cittie of London, I finde by exact obseruations to be about 71. degrées 50. minutes. The forme of the Instrument héere described, with the manner of the declination, I haue héere placed that it may be the easier conceiued.



The fift Chapter.

That in the vertue of the Magnes or Loadstone, is no pondrous or weightie matter, to cause any such declining in the Needle.

BEcause the opinions of men are diuerse, and the arguments of many against reason peraduenture ther are some will say, that I am deceyued euen in the ground & chiefest point of this my purpose, alledging

(as some haue alredie done without reason) that this Declyning of the Nædle, is caused by some ponderous substance that it receiueth from the Stone, and not (as I take it) to proceede of the simple vertue, & secret influence thereof, because the stone it selfe wherin the vertue remaineth and is nourished, is weightie.

I iudge the learned will not allow a Spirit to haue anie corporal substance or weight, or that it may sensibly be felt: if anie should, yet by two conclusions it is easily proued, ỳ the vertue of this Stone containeth in it no waightie matter: and thus found.

Take three or foure small peces of yron or Steele wier, and putting them in a fine gold Ballance, counterpoise them iustly with Leade: Then take them out and touch them well with the stone, that they may receiue the virtue therof: And after weie them againe in the same ballance, with the same Lead, and you shall finde them to weie no more, thẽ before they were touched, though euery one of them haue receiued vertue sufficient to lift vp his fellowe.

Secondlie, if the North point of the Nædle doe Decline by anie ponderous or weightie matter, in the vertue receiued by touching the Stone, why then should not the South point of the Nædle being touched with ỳ contrary end of the Stone, haue the same Declyning Southwards, being all one Stone, and one vertue? Or why doeth not this supposed heauier end, lai perpendicularly to the Centre, as by reason it should, and not couet a certaine scituation beside it, ballancing it selfe vp and downe, till it haue found the same? These argumentes may aunswere this matter. For touch the Nædle with what part of the Stone you list, that end of the Nædle that sheweth the North, will alwayes Decline.

The sixt Chapter.

A confutation of the common receiued opinion of the point Attractiue.

Seing

Seing it is manifest that there is a Declining in the Nædle, & that the same is not caused by anie ponderous weightie matter in the vertue receiued frō the Stone: it may be demanded, by what means this Declining or elcuating happeth & in which of the two poincts consisteth the action or cause thereof.

Peraduenture you will saie (as other haue imagined) that it is in the South poinct of the Nædle, elcuated by the Attractiue vertue of some poinct of the Heauen that waie. Perchance you will yeld it rather to bee in the North poinct of the Nædle, which by some Attractiue poinct in the Earth, or in the Heauens, beyond the Earth that waie, is drawen downe and caused to Decline, and it Declining, of necessitie the other South poinct opposite must needes be lifted vp.

Your reason towards the earth carrieth some probabilitie, but I proue that there be no Attractiue, or drawing propertie in neither of these two partes, then in the Attractiue point lost, and falselie called the poinct Attractiue, as shall be proued. But because there is a certaine poinct, that the Nædle alwaies Respecteth or sheweth, beeing voide and without anie Attractiue propertie, in my iudgement this poinct ought rather to bee called the poinct Respectiue.

And further, if it may be proued, that there is no Attractiue or drawing propertie in that poinct, the power & action in that poinct condemned, then of necessitie the power and propertie, without anie externall cause, remaineth onelie in the Stone, and after in the Nædle beeing touched with it, hauing the same power & propertie in it, that the Stone hath in euerie respect.

Now to proue no Attractiue poinct neither beneath in the earth, nor heauens Northwardes, nor aboue in the heauens Southwardes, you shall take a peece of Yron or

Steele

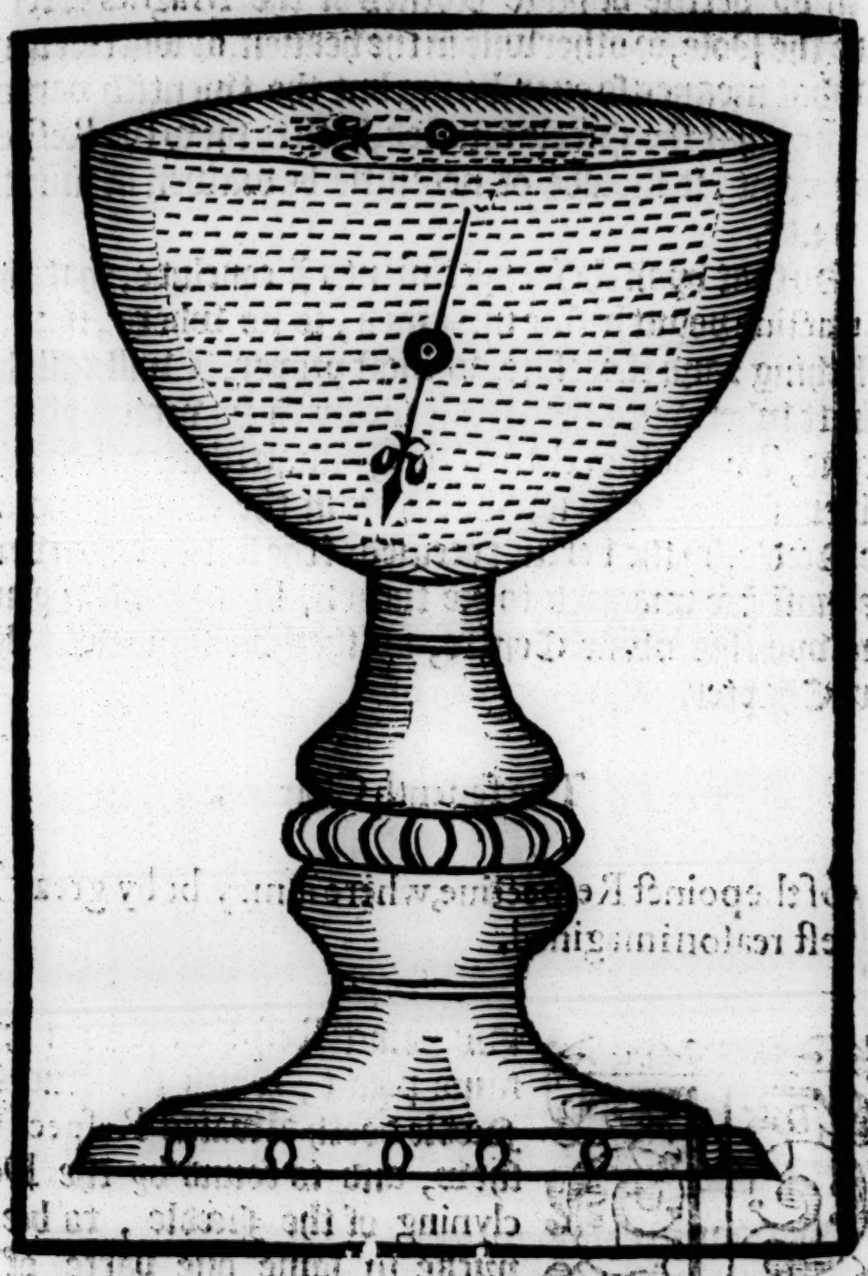
Steele wier of two inches long or more, and thrust it into a peece of close Corke, as bigge as you thinke may sufficiently beare the wier on the water, so as the same Corke rest in the middle of the wier.

Then you shall take a deepe glasse, bole cuppe, or other vessell, and fill it with faire water, setting it in some place where it may rest quiet and out of the winde. This done, cut the Corke circumspectlie by little and litle, vntill the wier with the Corke be so fitted, that it may remaine vnder the superficies of the water two or three inches, both ends of the wyre lying leuell with the superficies of the water, without ascending or decending, lyke to the beame of a paire of ballance beeing equallie poised at both endes.

Then take out of the same wire without mouing the Corke, and touch it with the Stone, the one end with the South of the stone, and the other end with the North, and then set it againe in the water, and you shall see it presently turne it selfe vpon his owne Centre, shewing the aforesayd Declyning propertie, without descending to the bottome, as by reason it should, if there were anie Attraction downwards, the lower part of the water beeing nerer that point, then the superficies thereof.

And as this may prooue no Attraction or drawing downwards: in like maner the Corke being so made, that it may sinke very slowly to the bottome, and then taken out and touched with the Stone, and put in againe downe to the bottome with your finger, if any Attractiue drawing were vpwards, it would ascend, and come vp to the superficies of the water, beeing nerer to that point than the bottome. But I finde by diligent and exact triall, that it hath no such effecte: as in the figure following is demonstrated.

Againe,



Againe, if you doe fit your wter with Corke, that after it is touched with the ſtone, it will ſwim teuell in the ſuperficies of the water, you ſhall ſee it turne to ſhew the true Variation, and leauing the ſame in the middle of the ſuperficies of the water, ſo long as you liſt, you ſhall finde that it will not bee drawen from his place, neither to the one ſide, nor the other, whereas if there were anie ſuch Attractiue poinct as haue beene imagined, either in the

Stéele wier of two inches long or more, and thrust it into a péece of close Corke, as bigge as you thinke may sufficiently beare the wier on the water, so as the same Corke rest in the middle of the wier.

Then you shall take a déepe glasse, bole cuppe, or other vessell, and fill it with faire water, setting it in some place where it may rest quiet and out of the winde. This done, cut the Corke circumspectlie by little and litle, vntill the wier with the Corke be so fitted, that it may remaine vnder the superficies of the water two or thrée inches, both ends of the wyre lying leuell with the superficies of the water, without ascending or decending, lyke to the beame of a paire of ballance béeing equallie poised at both endes.

Then take out of the same wire without mouing the Corke, and touch it with the Stone, the one end with the South of the stone, and the other end with the North, and then set it againe in the water, and you shall sée it presently turne it selfe vpon his owne Centre, shewing the aforesayd Declyning propertie, without descending to the bottome, as by reason it should, if there were anie Attraction downwards, the lower part of the water béeing nérer that point, then the superficies thereof.

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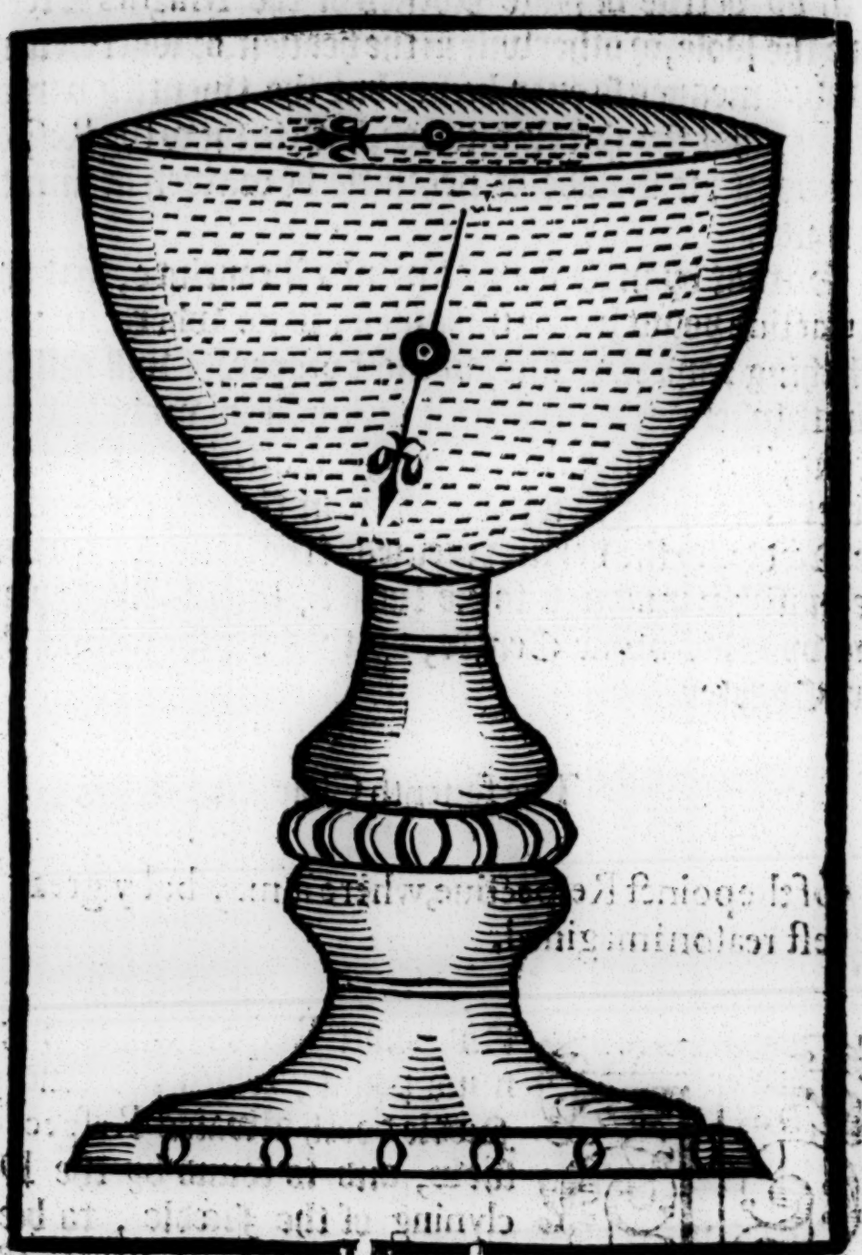
Againe,



Againe, if you doe fit your wier with Corke, that after it is touched with the stone, it will swim teuell in the superficies of the water, you shall see it turne to shew the true Variation, and leauing the same in the middle of the superficies of the water, so long as you list, you shall finde that it will not bee drawen from his place, neither to the one side, nor the other, whereas if there were anie such Attractiue point as haue beene imagined, either in the

earth by vertue of huge Rockes of the Magnes Stone neere the Pole, or otherwise in the heauen, or wheresoeuer, by what meanes so euer, beeing but the twentith part of the force that the Needle touched, hath to shew the Respectiue point, it shoulde of necessitie be drawen in time to some side.

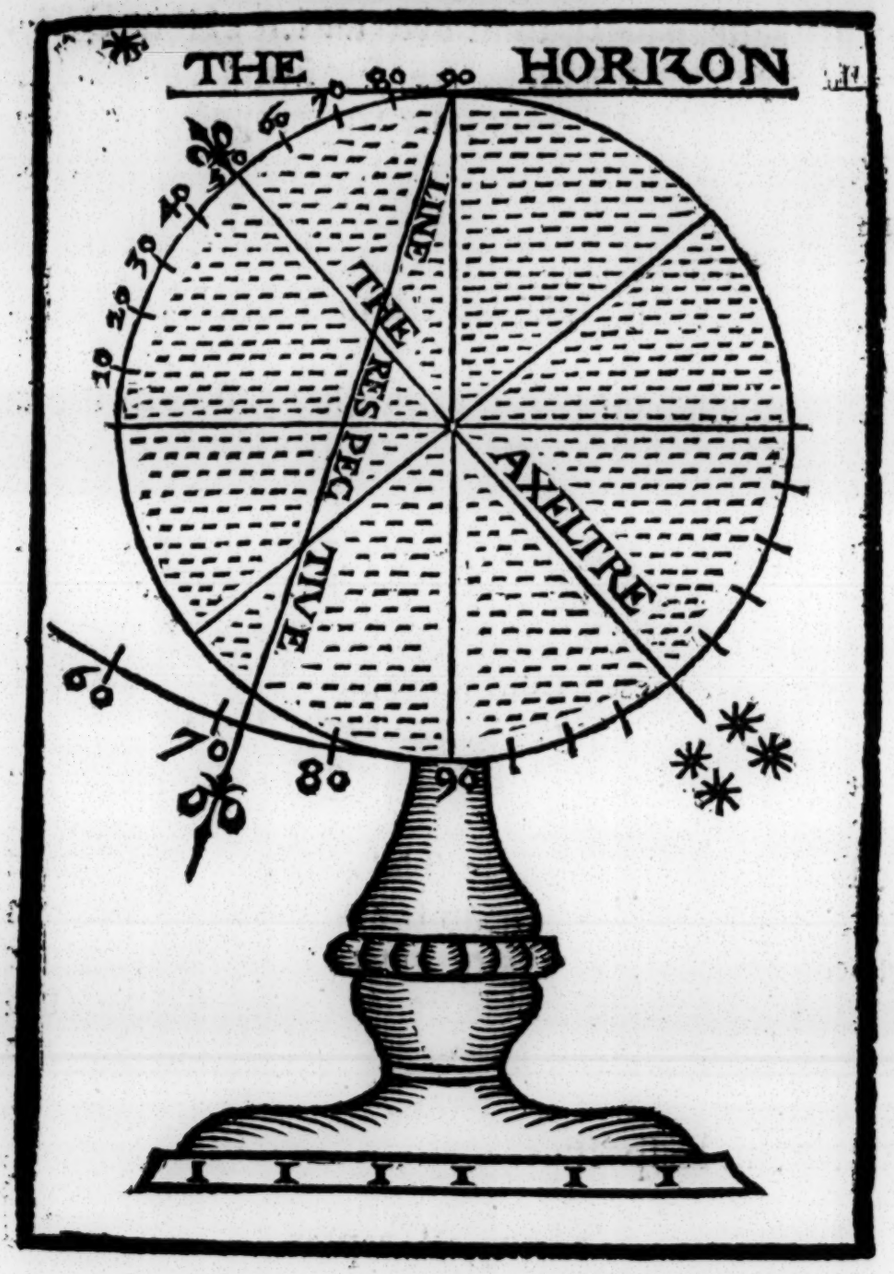
So that vpon these experiments I conclude, that the Attractiue point before imagined, is no where, nor no such thing: and therefore, as most proper, I will call the poinct whereunto the Needle inclineth by vertue of the Stone, The poinct Respectiue, and attribute the whole power of shewing that poinct to bee in the Stone, and in the Needle, by the vertue receiued of the stone, which vertue must bee imagned to bee turned, borne, and depending vpon his owne Centre, as shall bee shewed in the next Chapter.

The seuenth Chapter.

Of the poinct Respectiue, where it may be by greatest reason imagined.

THis poinct Respectiue, is a certaine poinct, which the touched Needle doeth alwaies Respect or shew, and is found by the Declyning of the Needle, to bee a pricke in some one parte of a straight line, Declining in this place or Latitude of London vnder the Horizon 71. degrees, and 50. Minutes, as this figure following representeth.

This



This streight line must be imagined to proceede from the Centre of the Needle, into the Globe of the earth, extending & going directly forth both waies infinitlie. But in what part of this line the point Respective is, it is not by this bare line alone to be answered, no more then it is possible by one bare angle to measure or know ỹ distance of anie place assigned.

And for the finding or certaine assigning of ỹ true place of this point Respective, we must leaue vntill the expert

trauailer haue made certaine obseruation of this Declyning of the Needle in other places. For seeing it is certaine that though in seuerall Horizons, the compasse hath seueral Variations: yet in anie one Horizõ, the needle Respecteth alwaies one onelie point without alteration, as by trauaile is trulie proued. So I iudge, that in his Declyning, it keepeth the lyke order and certaintie in euerie place.

And although the Needle of the Compasse, by reason of the weight of the heauie flie, cannot Decline, as his propertie is, but falselie sheweth the point Respectiue alwaies in the Horizon, as most necessarie so to doe for the Nauigation: yet by the meanes and conclusions, which before I haue shewed, the diligent trauailer hauing with him a good Magnes or Loadstone, may by exact obseruation finde the encreasing or decreasing of this Declining of the needle, as his trauaile shall giue occasion.

For I am of this opinion, (and that by great reason) that this Declining of the Needle shall be found by trauell to be great or little, according as the distaunce of the point Respectiue, is from the place where the triall is made: which beeing diligentlie obserued in sundrie places, with the certaine Variation of the Needle from the Meridian, tehrby may be demonstrated and found out the true place of this point Respectiue.

The eight Chapter.

Certaine proofes that the power and action is wholie and freelie in the stone, to shew this poinct Respectiue: and in the Needle, by vertue & power receiued of the Stone: and not forced or constrained by anie Attraction in heauen or earth.

IT is most manifest in all the workes of Nature, or creatures that God hath made, that whatsoeuer qualitie, propertie, or vertue is found in them, by creation, that is to bée holden for their owne. And he that shall, by imagination or coniecture, go about to take these their properties from them, and attribute the same to anie other subiect whereunto they appertaine not, I saie that men offendeth god much, for not beléeuing his power to be sufficient in his creatures.

I wil not offer to dispute with the Logitians in so many poincts as héere they might séeme to ouer reach me, in naturall causes. But that this Stone hath wholie & fullie in himselfe, power, action propertie, & vertue of his owne appetite, to shew, and to cause ỹ Nædle to shew the poinct Respectiue, without anie Attractiue qualitie, or externall cause in Rockes of the Magnes Stone, or by Attraction in the heauens, or else where whatsoeuer, it is alreadie sufficientlie proued.

Notwithstanding, if these proues may not content, I will at anie time required héerein, satisfie the doubtfull by manifest experiments. And therfore where no other cause can be probalie annexed vnto this stone, the power and action of necessitie is proued in it selfe.

And by the Declining of the Nædle, is also proued, that the poinct Respectiue is rather in the earth thē in the heauens. as some haue imagined: and the greatest reson why they so thought, as I iudge, was because they neuer were acquainted with this Declining in ỹ Nædle, which doubtlesse if Martin Curtes had knowen, he would not haue iudged the Attractiue poinct to haue ben in the heauens, or without them, but rather in the earth.

Now peraduenture you will aske me how this Stone hath his power, and how it is ingendered: I am no more able to satisfie you héerein, then if you shuld aske me how

and by what meanes the celestiall spheres are moued: but that God in his omnipotent prouidence hath appointed it so to be: which may serue for a generall answer, to all such curious searchers of the secret workes of God in his creatures. As though his worde alone were not a sufficient decrée and lawe to all his workes: but binding them to second causes, as a thing of necessitie.

these curious searchers out of the secrets of Nature, further then is requisite that man should know for his necessarie vse, I may compare to Esdras, and wish them to read ouer his fourth booke, and there they shall sée how he was answered at Gods hands by his Angell, for his curious questions asked and demaunded.

Now therefore, as I haue before declared, that diuerse haue whetted their wits, yea, & dulled them, as I haue mine, and yet in the end haue bene constrained to flie to the corner stone, I meane God, who (to conclude) hath giuen vertue and power to this Stone, proper in it selfe, to shew one certaine point, by his owne nature and appetite, and not subiect to anie other accident in heauen, nor in earth, but frélie by his owne proper vertue receiued at his mightie hands in creation: and by the same vertue the Néedle is turned vpon his owne Centre, I meane the Centre of his Circular and inuisible vertue, pearcing all things, and staied by nothing, bée it wall, boord, glasse, or anie thing whatsoeuer.

And surely I am of opinion, that if this vertue could by anie meanes be made visible to the eie of man, it would be found in a Sphericall forme extending round about the Stone in great compasse, and the dead bodie of the Stone in the middest thereof, whose Centre is the Centre of his aforsaid vertue. And this I haue partly proued and made visible to be séene in some manner, and God sparing mée life, I will hérein make further experience, and that not curiouslie, but in the feare of God, as néere as he shal giue me grace, and meane to annexe the same vnto a booke of

Nauiga-

Nauigation, which I haue had long in hand.

The ninth Chapter.

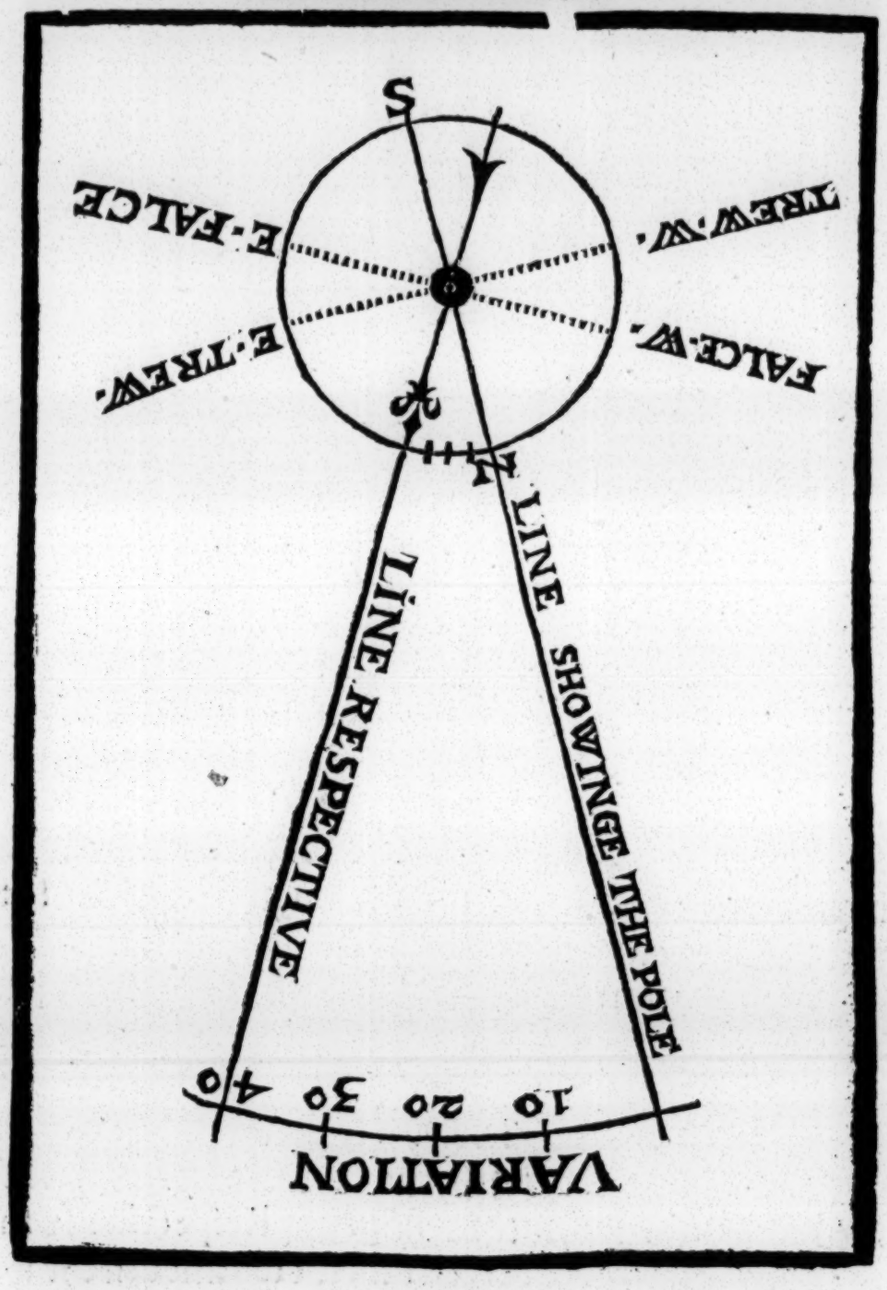
Of the Variation of the Needle, from the pole or Axeltree of the earth, and how it is to be vnderstood.

NOW, as the Néedle hath this apparaunt propertie in Declining vnder the Horizon, to shew the point Respectiue: So it is most manifest that as in Declining it hath a propertie in varying, or departing from the Poles, euen as the point Respectiue openeth, or sheweth a greater, or lesser distãce betwixt the sayde point Respectiue, and the Pole or Axeltre of the earth. And this departing is called Variation of the Néedle. This is also shewed in the Néedle or wier, in that conclusion of declining in the water, as in the first Chapter, euen by the same proportion, that it showeth in the Néedle Horizontally.

This Variation is no other thing, than a certaine part or portion of a circle, contained betwixt two straight lines procéeding both from one Centre, which may be imagined to be the Centre of the Néedle, & from thence both extending and going directly forth, one to the Pole or Axeltrée of the world, and the other to the point Respectiue: & this part of circle contained betwixt these two lines in the Horizon, is sayd to be Variation.

And further héere is to be noted, that alwayes these two lines haue two right lines, cutting them directly in the Centre of the Néedle. The one of them crossing the Viridian at right angles in the Centre of the Néedle, is ỳ true East and West of the world. And the other crossing the line Respectiue at right angles, is the false East and west that the varying Néedle or Compasse sheweth: all which is shewed by this présent figure following.

This



This Variation is iudged by diuerse trauailers to bée by equall proportion, but héerein they are much deceiued, and therefore it appeareth that notwithstanding their trauaile, they haue more followed their bookes then experience in that matter. True it is, that Martin Curtes doth allowe it to bée by proportion, but it is a most falle and erronious rule. For there is neither proportion nor vniformitie in it, but in some places swift and sudden, and in some places slowe.

It

It is said to be proportionall or vniforme, when in the increasing or decreasing of a degree of Variation, is found one certaine number of leagues or miles, going, increasing or decreasing in one Paralell or latitude, by like equall proportion, and that if the Variation be doubled, going by one Paralel, so shall the leagues or miles also. But this is not found to be so.

For in going from Sillie to Newfound-land, which is not 600. Leagues, it is found that the Needle doth varie more in 200. Leagues, when you come neere that Countrie, then it doth in 400. Leagues of your first way. And also going to Meta Incognita, it varieth more in part of the last of the way, the in ⅓ of the first: and in those partes it is found to be sodaine. Further it is found betweene the North cape and Vaigatz verie strange, in recoiling and comming backe againe to the Westwardes of the Pole, before it hath fullie accomplished two points of Variation in the Compasse. So that a Vaigatz it varieth to the Westwards, as it doth at Newfound-land. And this comming backe againe, before it hath accomplished four points of the Compasse, is verie strange, and against the opinions of all that haue before written.

Because the line of the Nedle that sheweth the Pole Artik, and point Respectiue, by vertue of the stone passeth betweene Silly and Newfound-land

Pedro de Medina (as I haue said in the second Chapter) was doubtfull of the Variation, saying: that if the Compasse did varie, the fault might bee in the making thereof, the wiers or needle not being well placed: yet he was a learned man, and a great traueller to the West Indies. But it apeareth that hee had no more regard to the Variation, then many Mariners in these daies.

For in 18. or 20. yeares that I haue traueiled the seas beeing daily conuersant with manie of them, and diligent in enquiring of Variation of the places, where I haue not beene my selfe, I could neuer finde two of them in one truth, except for the trauailes from hence Northwards, and North Eastwards. But I suppose the greatest occasion thereof is by lacke of exact Instruments for

that purpose. Wherefore I haue deuised one verie necessarie.

And further, because this Variation is diuerse, and is found sometimes to the Eastwards, and sometimes to the Westwards of the Pole, I wil declare what ỹ Variation is héere in London, by mine owne obseruation, and in other places, as I haue grossie gathered of some trauelers, reckoning or beginning at the ancient boũd or great Meridian that passeth by the Ile of Saint Michael in the Asores, where it is said, that the Nédle sheweth directly the Pole, and the Respective point both in one line. But this is not found to be so.

True it is, that the North point of the common Compasse sheweth the Pole very nére in that Meridian, but the bare Nédle sheweth about 4. deg. 50. min. to the eastwards of the Pole. So that you must vnderstãd alwaies, the difference betwixt the common Compasse & the Nédle to be at the least $\frac{1}{3}$ part of a point, and of some more: because the greatest part of the common sailing Compasses hath the Nédle set in the Flie, halfe a point, or $\frac{2}{3}$ to the Eastwardes of the North, and some $\frac{3}{4}$ of a point, and others at a whole point, and some againe are set directlie vnder the Flower de Luce, or North of the Compasse, these are called Meridionall Compasses, because they shew directly the Pole in the great Meridian, as the bare Nédle doth, which Meridian must nédes bee at the least 100. or 120. leagues to the Westwards of the Ile of saint Michaell.

And therefore to write of the Variation of places by the common reportes of Marriners that haue trauailed Southwards and Westwards from hence, it shall be as vncertaine, as are the diuers makings of these common compasses, by which they haue made their obseruations. And therefore I will omit it, and speake only of this place or Cittie of London, whose latitude I finde to bee 51. degrées, 32. min. and the Variation of the Nédle from this

Meridi-

Meridian of the Pole to be 11. degrees. 15. minutes.

And although this Variation of the Needle, be found in trauaile to be diuerse and changeable, yet at anie land of fixed place assigned, it remaineth alwaies one, still permanent and abiding. And therefore I wish the Marriner to make diligent obseruation of this Variation in diuerse places, as hee shall trauaile, by some exact Instruments for the purpose. For it may be greatly for his aid, against he come there another time, especially in such places where the variation is swift, as in these North parts. And because the common Compasse is partaker of this Variation and Declining, as the Needle is, I will somewhat shewe of the sundrie sortes and makings of them, with the inconueniences that may grow by them, and by ill plats made by these diuerse sortes of Compasses.

The tenth Chapter.

Of the common Compasses, and of the diuerse different sorts & makings of them with the inconueniences that may grow by them, and the Plats made by them.

OF these common sailing Compasses, I find heer in Europa fiue sundrie sorts or sets. The first is of Leuant made in Sicyle, Genoua and Venice: and these are all for the most part made meridionally with the wiers directlye set vnder the South and North of the Compas and therefore duelye shewing the point Respectiue in all places, as the bare Needle, and by this compasse are the Plats made, for the most part of all the Leuant Seas.

Secondly, there are made in Danske, in the Sound of

Denmarke, and in Flanders, that haue the wiers set at ¼ of a point to the Eastwards of the North of the Compasse and also some at a whole point, and by these Compasses they make both the plats, and Rutters for the sound.

Thirdly, there hath bene made in this Countrey particularlie for saint Nicholas and Russia, Compasses set at ⅓ of a point, & the first plats of that discouery were made by this Compasse.

Fourthly, the Compasse made at Siuill, Lisbone, Rochell, Bourdeaux, Roan, and héere in England, are most commonly set at halfe a point, and by this Compasse are the plats of the East and West Indies made for their Pilots, and also for our coasts néere herby, as France, Spain, Portugall, and England: and therefore best of these Nations to be vsed, because it is the most common sort that is generallie vsed in these coasts. And againe, it is sayd, that the middle hazard is best.

I speake thus, because there are so many sorts of these compasses different each from other, as before I haue declared. And the Maister or Marine sailing by these compasses of sundrie sorts, may thereby fall into great perrill, and the reason is, because that of long time these compasses haue bene vsed, and by them the Marine Plats haue bene described of sundrie sorts, euerie one according to the compasse of that Countrie.

If then hee take not the Compasse of the same set or making that the plat was made by, then his Card or plat will shew him one course: and the Compasse when hee thinketh he goeth well, will carrie him another way. And thus, when hee thinketh to fall with the place that his Card sheweth him, he shall be as farre wide, as the Compasse he hath sailed by, is different from that his plat was made by.

This is the ground and cause of many inconueniences, which is now too late to be generally reformed: therfore I wish the Marriner to haue a great regarde vnto this,

this, as a principall point in Nauigation, and not to saile by a Compasse of one parish, & a plat of another: I meane that they haue a respect, as neere as they may to saile by a Compasse of that countrie where his plat was made.

Yet manie there are that vse our Compasse with Leuant Plats, but I suppose, without good consideration therein, they shall make but wide reckonings. And this hath bene sufficientlie of late experimented, by our Mariners, that haue vsed Leuant.

Peraduenture there are some wil say, that he knoweth a good Compasse, if he see it. I say the Compasse may be good, and yet not good for him, except his plat be agreeable. As for example: A Leuant Compasse is a good Compasse to vse with a Leuant Plat, but it differeth from our compasse halfe a point more Easterlie. And others there are of Danske, that differ from ours ½ a point more Westerlie, and yet beeing vsed in their kind, are good compasses.

And therefore I conclude, that generallie the best compasse is this sort set at ½ a point, because the maior part of Compasses and plats, doth not differ from this aboue ¼ of a point, except the two aboue named of Leuant and Danske.

I haue heard many say, that haue trauailed farre to the Southwards, that the Compasse hath seemed to lose his force, and to ware weake and dull. I iudge the cause is not by reason of the farre distance from the North Pole, but rather by beeing long absent from the Stone, for not beeing touched or refreshed therewith. And againe, the Pinne that beareth the Flie, may be so dulled with long vsing, that the flie is as it were staied, that it cannot play as it would if it were sharpe.

Therefore, if you make it sharpe with a Whetstone, you shall finde it remedied: and also when you finde it light, or too tickle, you may dull the point of the Pinne, with the leafe of a paire of writing tables, vntill you may see the toppe thereof, and then the Compasse will bee

better for a high Sea. And thus by sharping and dulling of the Pinne, you may make your Compasse fit for all Weathers.

HEERE AFTER followeth a Table of the Sunnes *Declination, commonlie called a Re-*giment for the Sun, exactlie calculated vnto the minute by the true place of the Sun, whose greatest Declination for this age, is 23. Degrees, 28. Minutes, and may serue for 30. yeeres, without great errour.

IANVARIE.

South Declination.

First			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	21	50	1	21	52	1	22	54	1	21	56
2	21	41	2	21	44	2	21	47	2	21	49
3	21	30	3	21	34	3	21	36	3	21	39
4	21	20	4	21	24	4	21	26	4	21	29
5	21	9	5	21	13	5	21	16	5	21	18
6	20	8	6	21	2	6	21	4	6	21	7
7	20	47	7	20	50	7	20	53	7	20	56
8	20	35	8	20	38	8	20	41	8	20	44
9	20	23	9	20	26	9	20	29	9	20	32
10	20	10	10	20	12	10	20	16	10	20	18
11	19	57	11	20	0	11	20	3	11	20	6
12	19	43	12	19	46	12	19	49	12	19	52
13	19	30	13	19	33	13	19	36	13	19	39
14	19	16	14	19	19	14	19	23	14	19	27
15	19	0	15	19	5	15	19	7	15	19	11
16	18	45	16	18	49	16	18	52	16	18	56
17	18	30	17	18	33	17	18	37	17	18	41
18	18	15	18	18	19	18	18	22	18	18	26
19	18	0	19	18	4	19	18	7	19	18	11
20	17	44	20	17	46	20	17	51	20	17	54
21	17	27	21	17	30	21	17	34	21	17	38
22	17	11	22	17	14	22	17	17	22	17	21
23	16	53	23	16	56	23	17	0	23	17	5
24	16	35	24	16	39	24	16	43	24	16	48
25	16	18	25	16	21	25	16	25	25	16	30
26	15	59	26	16	4	26	16	8	26	16	13
27	15	40	27	15	46	27	15	50	27	15	55
28	15	22	28	15	27	28	15	31	28	15	36
29	15	3	29	15	8	29	15	12	29	15	17
30	14	44	30	14	48	30	14	53	30	14	58
31	14	24	31	14	29	31	14	34	31	14	39

FEBRVARIE.

First			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	14	5	1	14	10	1	14	15	1	14	20
2	13	45	2	13	51	2	13	55	2	13	59
3	13	25	3	13	30	3	13	35	3	13	40
4	13	5	4	13	10	4	13	14	4	13	20
5	12	45	5	12	50	5	12	54	5	12	0
6	12	24	6	12	30	6	12	34	6	12	40
7	12	3	7	12	8	7	12	13	7	12	19
8	11	42	8	11	47	8	11	52	8	11	58
9	11	21	9	11	26	9	11	31	9	11	36
10	10	0	10	11	5	10	11	10	10	11	15
11	10	39	11	10	44	11	10	49	11	10	54
12	10	17	12	10	22	12	10	27	12	10	33
13	9	54	13	10	0	13	10	5	13	10	11
14	9	32	14	9	38	14	9	43	14	9	49
15	9	10	15	9	16	15	9	21	15	9	27
16	8	48	19	8	54	16	8	59	16	9	5
17	8	26	17	8	32	17	8	52	17	8	43
18	8	3	18	8	9	18	8	37	18	8	20
19	7	41	19	7	47	19	7	14	19	7	58
20	7	18	20	7	24	20	7	29	20	7	35
21	6	55	21	7	1	21	7	6	21	7	12
22	6	32	22	6	38	22	6	43	22	6	49
23	6	9	23	6	15	23	6	20	23	6	26
24	5	46	24	5	52	24	5	57	24	6	3
25	5	22	25	5	28	25	5	34	25	5	40
26	4	59	26	5	5	26	5	10	26	5	16
27	4	35	27	4	41	27	4	47	27	4	53
28	4	12	28	4	18	28	4	23	28	4	29
									29	4	6

South Declination. South Declination. South Declination.

MARCH.

First.			Second			Third.			Fourth.		
D.	M.	G.	D.	M.	G.	D.	M.	G.	D.	M.	G.
1	3	49	1	3	54	1	4	0	1	3	42
2	3	26	2	3	31	2	3	36	2	3	19
3	3	2	3	3	7	3	3	13	3	2	55
4	2	38	4	2	43	4	2	50	4	2	31
5	2	14	5	2	19	5	2	26	5	2	7
6	1	50	6	1	55	6	2	2	6	1	43
7	1	27	7	1	32	7	1	38	7	1	21
8	1	4	8	1	9	8	1	15	8	0	57
9	0	40	9	0	45	9	0	51	9	0	33
10	0	16	10	0	21	10	0	28	10	0	9
11	0	8	11	0	2	11	0	4	11	0	14
12	0	32	12	0	26	12	0	20	12	0	38
13	0	56	13	0	50	13	0	44	13	1	2
14	1	20	14	1	14	14	1	8	14	1	26
15	1	43	15	1	37	15	1	31	15	1	49
16	2	6	16	2	0	16	1	54	16	2	13
17	2	30	17	2	24	17	2	17	17	2	36
18	2	53	18	2	47	18	2	41	18	2	59
19	3	17	19	3	11	19	3	5	19	3	23
20	3	39	20	3	34	20	3	29	20	3	46
21	4	3	21	3	57	21	3	41	21	4	10
22	4	25	22	4	20	22	4	15	22	4	32
23	4	49	23	4	43	23	4	37	23	4	56
24	5	12	24	5	7	24	5	1	24	5	18
25	5	36	25	5	30	25	5	24	25	5	42
26	5	57	26	5	53	26	5	48	26	6	4
27	6	20	27	6	16	27	6	10	27	6	27
28	6	43	28	6	38	28	6	33	28	6	49
29	7	6	29	7	1	29	6	55	29	7	12
30	7	29	30	7	24	30	7	18	30	7	34
31	7	51	31	7	46	31	7	41	31	7	57

South Declination. Line. North Declination.

South Declination. Line. North Declination.

South Declination. Line. North Declination.

AVGVST.

First.			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	15	21	1	15	26	1	15	30	1	15	17
2	15	3	2	15	9	2	15	13	2	14	59
3	14	44	3	14	50	3	14	55	3	14	40
4	14	26	4	14	32	4	14	36	4	14	22
5	14	8	5	14	14	5	14	18	5	14	4
6	13	49	6	13	54	6	13	59	6	13	44
7	13	29	7	13	35	7	13	40	7	13	25
8	13	10	8	13	15	8	13	21	8	13	6
9	12	15	9	13	56	9	13	2	9	12	47
10	12	32	10	12	37	10	12	42	10	12	28
11	12	12	11	12	17	11	12	23	11	12	7
12	11	52	12	12	57	12	12	2	12	11	47
13	11	31	13	11	37	13	11	42	13	11	27
14	11	11	14	11	17	14	11	22	14	11	7
15	10	51	15	11	56	15	11	1	15	10	46
16	10	30	16	10	36	16	10	41	16	10	25
17	10	9	17	10	14	17	10	19	17	10	3
18	9	47	18	9	52	18	9	58	18	9	42
19	9	26	19	9	31	19	9	37	19	9	21
20	9	5	20	9	10	20	9	15	20	8	59
21	8	44	21	8	48	21	8	54	21	8	38
22	8	22	22	8	27	22	8	33	22	8	16
23	8	0	23	8	5	23	8	11	23	7	54
24	7	38	24	7	44	24	7	49	24	7	32
25	7	16	25	7	22	25	7	26	25	7	10
26	6	53	26	7	59	26	7	4	26	6	47
27	6	31	27	6	37	27	6	41	27	6	25
28	6	9	28	6	15	28	6	19	28	6	3
29	5	46	29	5	52	29	5	57	29	5	40
30	5	23	30	5	29	30	5	34	30	5	17
31	5	7	31	5	1	31	5	11	31	4	55

North Declination. North Declination. North Declination.

SEPTEMBER.

First.				Second.				Third.				Fourth.			
D.	M.	G.		D.	M.	G.		D.	M.	G.		D.	M.	G.	
1	4	37	North Declination.	1	4	43	North Declination.	1	4	49	North Declination.	1	4	31	North Declination.
2	4	15		2	4	20		2	4	26		2	4	9	
3	3	52		3	3	58		3	4	4		3	3	46	
4	3	30		4	3	34		4	3	40		4	3	23	
5	3	6		5	3	12		5	3	18		5	3	0	
6	2	43		6	2	49		6	2	55		6	2	36	
7	2	19		7	2	25		7	2	31		7	2	13	
8	1	56		8	2	2		8	2	8		8	1	49	
9	1	34		9	1	39		9	1	44		9	1	27	
10	1	10		10	1	16		10	1	22		10	1	4	
11	0	47		11	0	53		11	0	58		11	0	40	
12	0	23	Line.	12	0	36	Line.	12	0	34	Line.	12	0	16	Line.
13	0	0		13	0	6		13	0	11		13	0	7	
14	0	24	South Declination.	14	0	18	South Declination.	14	0	12	South Declination.	14	0	31	South Declination.
15	0	48		15	0	41		15	0	36		15	0	54	
16	1	11		16	1	5		16	1	0		16	1	18	
17	1	24		17	1	28		17	1	23		17	1	40	
18	1	57		18	1	51		18	1	45		18	2	4	
19	2	21		19	2	15		19	2	9		19	2	27	
20	2	45		20	2	38		20	2	33		20	2	51	
21	3	8		21	3	2		21	2	57		21	3	14	
22	3	31		22	3	25		22	3	21		22	3	37	
23	3	54		23	3	48		23	3	43		23	4	1	
24	4	18		24	4	12		24	4	7		24	4	23	
25	4	40		25	4	34		25	4	29		25	4	47	
26	5	4		26	4	58		26	4	53		26	5	10	
27	5	27		27	5	21		27	5	16		27	5	34	
28	5	51		28	5	45		28	5	40		28	5	57	
29	6	13		29	6	8		29	6	2		29	6	19	
30	6	36		30	6	30		30	6	25		30	6	42	

IVNE.

First.				Second.				Third.				Fourth.			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	23	4	North.	1	23	4	North.	1	23	3	North.	1	23	6	North.
2	23	9		2	23	9		2	23	8		2	23	11	
3	23	13		3	23	12		3	23	12		3	23	13	
4	23	16		4	23	15		4	23	14		4	23	17	
5	23	19		5	23	18		5	23	18		5	23	20	
6	23	21		6	23	21		6	23	20		6	23	22	
7	23	23		7	23	23		7	23	22		7	23	24	
8	23	25		8	23	25		8	23	24		8	23	25	
9	23	26		9	23	26		9	23	26		9	23	26	
10	23	27		10	23	27		10	23	27		10	23	27	
11	23	28		11	23	28		11	23	28		11	23	28	
12	23	28	Tropic.	12	23	28	Tropic.	12	23	28	Tropic.	12	23	28	Tropic.
13	23	27		13	23	27		13	23	27		13	23	27	
14	23	26		14	23	26		14	23	26		14	23	26	
15	23	25		15	23	25		15	23	24		15	23	25	
16	23	23		16	23	24		16	23	22		16	23	23	
17	23	21		17	23	22		17	23	20		17	23	21	
18	23	19		18	23	20		18	23	18		18	23	18	
19	23	16		19	23	17		19	23	18		19	23	15	
20	23	13		20	23	13		20	23	14		20	23	12	
21	23	10		21	23	11		21	23	12		21	23	9	
22	23	5		22	23	6		22	23	8		22	23	4	
23	23	1		23	23	3		23	23	3		23	23	0	
24	22	56		24	22	57		24	22	59		24	22	54	
25	22	51		25	22	52		25	22	54		25	22	49	
26	22	45		26	22	46		26	22	48		26	22	43	
27	22	38		27	22	40		27	22	41		27	22	37	
28	22	32		28	22	33		28	22	34		28	22	30	
29	22	25		29	22	26		29	22	28		29	22	23	
30	22	17		30	22	20		30	22	22		30	22	16	

Declination.

IVLIE.

First			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	22	10	1	22	12	1	22	13	1	22	8
2	22	2	2	22	4	2	22	6	2	21	56
3	21	53	3	21	55	3	21	58	3	21	51
4	21	46	4	21	49	4	21	50	4	21	43
5	21	36	5	21	39	5	21	40	5	21	34
6	21	27	6	21	29	6	21	31	6	21	24
7	21	17	7	21	19	7	21	22	7	21	14
8	21	5	8	21	9	8	21	11	8	21	4
9	20	56	9	20	58	9	21	0	9	20	53
10	20	45	10	20	47	10	20	50	10	20	42
11	20	33	11	20	36	11	20	39	11	20	36
12	20	21	12	20	25	12	20	27	12	20	17
13	20	10	13	20	12	13	20	14	13	20	6
14	19	58	14	20	0	14	20	3	14	19	53
15	19	44	15	19	47	15	19	49	15	19	41
16	19	32	16	19	35	16	19	37	16	19	29
17	19	18	17	19	22	17	19	16	17	19	15
18	19	5	18	19	7	18	19	21	18	19	1
19	18	50	19	18	54	19	18	56	19	18	46
20	18	36	20	18	36	20	18	43	20	18	32
21	18	21	21	18	25	21	18	27	21	18	17
22	18	7	22	18	10	22	18	13	22	18	3
23	17	51	23	17	56	23	17	59	23	17	47
24	17	36	24	17	41	24	17	44	24	17	31
25	17	19	25	17	24	25	17	27	25	17	16
26	17	4	26	17	8	26	17	12	26	17	0
27	16	48	27	16	53	27	16	54	27	16	43
28	16	31	28	16	35	28	16	39	28	16	26
29	16	14	29	16	19	29	16	21	29	16	10
30	15	57	30	16	1	30	16	6	30	15	53
31	15	38	31	15	44	31	15	49	31	15	35

North Declination. North Declination. North Declination.

APRILL.

First.			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	8	12	1	8	8	1	8	2	1	8	18
2	8	35	2	8	30	2	8	23	2	8	41
3	8	57	3	8	52	3	8	46	3	9	3
4	8	18	4	9	13	4	9	8	4	9	24
5	9	41	5	9	35	5	9	29	5	9	45
6	10	1	6	9	50	6	9	50	6	10	7
7	10	23	7	10	18	7	10	12	7	10	29
8	10	45	8	10	39	8	10	34	8	10	50
9	11	5	9	11	0	9	10	55	9	11	10
10	11	26	10	11	20	10	11	15	10	11	31
11	11	46	11	11	41	11	11	36	11	11	51
12	12	6	12	12	2	12	11	56	12	12	11
13	12	27	13	12	22	13	12	16	13	12	32
14	12	46	14	12	42	14	12	36	14	12	51
15	13	5	15	13	1	15	12	55	15	13	10
16	13	25	16	13	20	16	13	15	16	13	29
17	13	45	17	13	40	17	13	35	17	13	49
18	14	4	18	13	59	18	13	54	18	14	8
19	14	22	19	14	18	19	14	14	19	14	26
20	14	40	20	14	36	20	14	32	20	14	45
21	14	59	21	14	55	21	14	51	21	15	4
22	15	18	22	15	13	22	15	9	22	15	22
23	15	35	23	15	31	23	15	27	23	15	39
24	15	53	24	15	49	24	15	45	24	15	57
25	16	11	25	16	7	25	16	2	25	16	15
26	16	27	26	16	23	26	16	20	26	16	31
27	16	45	27	16	41	27	16	36	27	16	48
28	17	1	28	16	6	28	16	53	28	17	5
29	17	17	29	17	13	29	17	10	29	17	20
30	17	33	30	17	29	30	17	25	30	17	37

North Declination. North Declination. North Declination.

MAY.

First			Second.			Third.			Fourth		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	17	49	1	17	45	1	17	42	1	17	53
2	18	4	2	18	1	2	17	57	2	18	8
3	18	19	3	18	15	3	18	12	3	18	23
4	18	33	4	18	30	4	18	26	4	18	37
5	18	48	5	18	45	5	18	40	5	18	51
6	19	2	6	18	39	6	18	55	6	19	6
7	19	16	7	19	13	7	19	10	7	19	20
8	19	30	8	19	17	8	19	25	8	19	33
9	19	43	9	19	39	9	19	36	9	19	46
10	19	55	10	19	51	10	19	49	10	19	59
11	20	5	11	20	5	11	20	2	11	20	11
12	20	19	12	20	17	12	20	14	12	20	23
13	20	31	13	20	29	13	20	26	13	20	35
14	20	43	14	20	41	14	20	38	14	20	46
15	20	55	15	20	52	15	20	49	15	20	58
16	21	5	16	21	3	16	20	59	16	21	8
17	21	16	17	21	13	17	21	10	17	21	19
18	21	25	18	21	24	18	21	20	18	21	28
19	21	35	19	21	33	19	21	30	19	21	38
20	21	45	20	21	43	20	21	40	20	21	48
21	21	52	21	21	51	21	21	49	21	21	4
22	22	1	22	21	59	22	21	56	22	22	54
23	22	9	23	22	8	23	22	6	23	22	11
24	22	17	24	22	15	24	22	13	24	22	19
25	22	24	25	22	23	25	22	21	25	22	26
26	22	31	26	22	30	26	22	27	26	22	33
27	22	38	27	22	37	27	22	34	27	22	39
28	22	55	28	22	42	28	22	41	28	22	46
29	22	50	29	22	49	29	22	47	29	22	52
30	22	55	30	22	54	30	22	53	30	22	56
31	23	1	31	23	0	31	22	58	31	23	2

North Declination.

North Declination.

North Declination.

OCTOBER.

South Declination.

First.			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	6	59	1	6	53	1	6	48	1	7	5
2	7	22	2	7	16	2	7	10	2	7	27
3	7	45	3	7	39	3	7	33	3	7	50
4	8	7	4	8	1	4	7	56	4	8	12
5	8	30	5	8	24	5	8	18	5	8	35
6	8	52	6	8	46	6	8	41	6	8	57
7		14	7	9	7	7	9	31	7	9	19
8	9	36	8	9	29	8	9	25	8	9	40
9	9	58	9	9	51	9	9	46	9	10	2
10	10	19	10	10	13	10	10	8	10	10	24
11	10	42	11	10	35	11	10	30	11	10	46
12	11	3	12	12	57	12	10	52	12	11	8
13	11	24	13	11	18	13	11	13	13	11	28
14	11	45	14	11	38	14	11	34	14	11	49
15	12	5	15	11	59	15	11	55	15	12	10
16	12	26	16	12	20	16	12	16	16	12	31
17	12	46	17	12	40	17	12	36	17	12	51
18	13	6	18	13	0	18	12	56	18	13	11
19	13	26	19	13	20	19	13	15	19	13	31
20	13	46	20	13	40	20	13	35	20	13	51
21	14	6	21	14	0	21	13	55	21	14	11
22	14	25	22	14	20	22	14	15	22	14	30
23	14	44	23	14	39	23	14	34	23	14	49
24	15	3	24	14	58	24	14	54	24	15	8
25	15	22	25	15	17	25	15	12	25	15	26
26	15	40	26	15	35	26	15	31	26	15	45
27	15	59	27	15	54	27	15	50	27	16	4
28	16	17	28	16	12	28	16	8	28	16	21
29	16	34	29	16	29	29	16	25	29	16	38
30	16	52	30	16	47	30	16	43	30	16	56
31	17	10	31	17	4	31	17	0	31	17	13

NOVEMBER.

South Declination.

First			Second.			Third.			Fourth.		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	17	25	1	17	20	1	17	17	1	17	29
2	17	42	2	17	38	2	17	33	2	17	46
3	17	58	3	17	54	3	17	51	3	18	2
4	18	13	4	18	10	4	18	6	4	18	17
5	18	28	5	18	25	5	18	21	5	18	32
6	18	44	6	18	39	6	18	36	6	18	48
7	18	59	7	18	55	7	18	51	7	19	2
8	19	14	8	19	10	8	19	6	8	19	17
9	19	29	9	19	25	9	19	21	9	19	32
10	19	42	10	19	38	10	19	34	10	19	45
11	19	55	11	19	51	11	19	47	11	19	59
12	20	8	12	20	5	12	20	2	12	20	11
13	20	20	13	20	17	13	20	14	13	20	24
14	20	33	14	20	30	14	20	27	14	20	36
15	20	45	15	20	42	15	20	39	15	20	49
16	20	55	16	20	54	16	20	51	16	20	59
17	21	8	17	21	6	17	21	2	17	21	11
18	21	19	18	21	17	18	21	13	18	21	22
19	21	29	19	21	27	19	21	24	19	21	32
20	21	40	20	21	37	20	21	34	20	21	42
21	21	50	21	21	48	21	21	45	21	21	51
22	21	58	22	21	54	22	21	52	22	22	0
23	22	7	23	22	5	23	22	2	23	22	8
24	22	15	24	22	12	24	22	11	24	22	16
25	22	23	25	22	21	25	22	19	25	22	25
26	22	30	26	22	28	26	22	26	26	22	32
27	22	37	27	22	35	27	22	33	27	22	39
28	22	44	28	22	42	28	22	40	28	22	46
29	22	50	29	22	49	29	22	47	29	22	52
30	22	55	30	22	54	30	22	53	30	22	57
31											

Prime.	Ianuarie.	Februarie.	March.	Aprill.	May.	Iune.	Iulie.	Auguſt.	September	October.	Nouember	December.
	18	17	19	17	17	15	15	13	11	11	9	9
1	11	6	0	15	4	15	0	8	15	2	6	0
	12	0	5	44	46	35	47	43	51	0	54	9
2	7	6	7	6	6	4	4		1	30	28	28
	14	5	23	16	10	23	12	23	8	3	13	0
	0	5	50	54	14	11	41	7	51	50	25	34
	26	25	27	25	25	23	23	21	20	19	18	17
3	12	2*	6	9	1	16	6	18	8	19	6	17
	56	48	0	48	27	24	44	50	1	23	11	19
	16	14	15	13	13	11	11	10	8	8	6	6
4	2	12	0	12	3	17	8	0	15	5	1!	7
	3	50	38	55	3	19	20	14	38	53	16	35
	4	3	4	3	2 31	30	30	28	27	27	25	25
5	18	4	14	0	10 31	10	0	16	9	2	18	8
	21	23	6	10	0 17	11	51	45	32	32	0	15
	23	22	23	22	21	19	19	17	16	16	14	14
6	20	6	15	0	8	*17	4	18	9	3	21	14
	5	32	20	17	15	40	54	10	49	15	47	39
	13	11	13	11	11	9	8	7	5	5	3	3
7	9	19	7	16	0	7	15	1	14	3	21	16
	23	0	36	30	9	39	48	20	0	58	15	21
	2	1	1 31	29	29	27	26	24	23	23	21	21
8	11	5	19 7	16	1	8	16	23	10	0	16	11
	40	5	46 37	56	0	0	48	53	44	2	24	14
	20	19	20	19	18	17	16	14	13	12	10	10
9	5	0	17	5	16	0	8	15	0	9	21	12
	56	45	4	45	24	49	24	51	5	47	58	56
	9	8	9	8	8	6	5	4	2	2 31	29	29
10	6	0	18	11	1	13	23	8	16	1 10	22	11
	40	36	49	39	54	47	50	33	48	17 45	0	11

Prime.	Ianuarie.	Februarie.	March.	Aprill.	May.	Iune.	Iulie.	Auguſt.	September	October.	Nouember.	December.
	28	26	28	27	26	25	23	23	21	21	19	18
11	2	17	12	4	19	9	21	7	17	3	12	23
—	0	23	2	43	54	18	20	38	41	6	31	5
	17	15	16	15	15	13	13	11	10	9	8	7
12	10	23	14	5	20	12	3	17	5	17	4	15
—	35	56	17	26	55	13	12	0	54	29	38	12
	6	4	5	4	3	2	2	30	29	28	27	26
13	1	11	22	10	23	13	4	11	2	17	5	17
—	29	56	47	47	36	18	19	20	29	0	46	22
	25	23	24	23	22	21	20	19	18	17	16	16
14	3	13	22	8	19	6	*20	11	4	21	14	5
—	44	35	40	46	3	51	45	51	22	51	30	20
	14	13	14	12	12	10	10	8	7	6	5	5
15	18	5	15	23	7	16	2	14	5	21	16	10
—	23	50	0	35	51	29	33	45	22	48	21	47
	4	2	3	1	30	28	28	26	25	24	23	23
16	4	18	6	16	7	15	0	10	0	16	10	6
—	17	40	35	20	32	17	3	40	0	12	17	8
	22	20	22	20	20	18	17	15	14	13	12	12
17	0	16	5*	16	0	8	15	23	8	20	11	5
—	39	45	55	25	42	6	32	13	47	50	55	32
	11	9	11	10	9	8	7	5	3	3	1	1 | 31
18	0	19	13	3	15	0	8	16	23	8	19	9 | 1
—	32	43	0	4	3	32	25	0	36	43	44	18 | 27
	29	28	30	27	28	26	26	24	23	22	20	20
19	19	13	6	22	11	22	8	16	1*	10	20	7
	12	42	56	30	38	7	0	25	6	3	26	19

Hereafter followeth three Tables, the first is of the Coniunctions of the sunne and Moone: the second of their oppositions, exactly drawen out of Ioannes Stadius Ephemerides: and the third of the Prime and mooueable Feasts.

IN the two first Tables in euerie square of euerie Colome, you shall finde noted thrée numbers, which haue seuerall significations: the first number is for the daie of the Moneth, the second for Houres, and the third for Minutes, of the middle instãt of time, for the coniuction or opposition of the Sunne and Moone.

Ye are to note, that the naturall daie accounted in these Tables, beginneth alwaies at the instant of noone or midday, and continueth till the next day noone, which is the iust time of 24. houres.

Therefore, when you finde the second number in anie square of the two first Tables, to exceed 12. the same is to be accounted with the Minutes following, (which is the third number) for so much after midnight, or of the morning, or forenoone of the next day.

The vse of the Tables.

FIrst seeke in the third Table the Prime, answerable to the yeare of our Lorde. Then returne to the Table of Coniunction, or opposition of the Moone: and in the first colome seeke the same number of the Prime. Then in the head of the Table, you shall seek the Moneth, for

for which you desire to knowe the coniunction or opposition: and descending downe the same Colome, til you come against the Prime specified, in that square you shall finde three numbers noted, the first is for the day of the moneth, the second the houre, and the third the minutes to bee adioyned with the houre, for the middle instant of time, of the coniunction or opposition.

Example.

THis yeare 1581. I desire to know the day of the Mones Coniunction or Change, in the Moneth of August, I seeke in the third Table (or Table of the moueable Feasts) for the Prime, and finde it to be 5. with which number I returne vnto the first Table, (which is the table of the coniunction or change) and finde the same in the first Colome. Then I seeke in the head of the Table for August, and discending downe in the same Colome, till I come to the square which answereth to the Prime 5. I finde therein noted 28——16——45. which signifie that the coniunction is the 28. day of the Moneth, at 16.H———45.M——and because the second number exceedeth 12. therefore I say that the coniunctinn shall bee the 29. day at 4.H———45——M. in the morning.

But if you find in anie one square three numbers double noted, they doe signifie, that in the same Moneth there is two coninnctions or oppositions, and likewise doe shewe the dates, houres, and minutes thereof.

If in anie square in the Colome of anie moneth in the Table of Coniunction, you finde noted this marke *. the same doth signifie the Eclipse of the Sunne at the instant of time noted for the coniunction in that moneth.

Likewise, if in any square in the Table of the oppositions or full Mones, you finde this marke ☾. the same doth signifie the Eclipse of the Mone, at the instant of time noted in the same square.

DECEMBER.

First.				Second				Third.				Fourth.			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	23	2	South	1	23	0	South	1	23	58	South	1	23	3	
2	23	6		2	23	4		2	23	4		2	23	7	
3	23	11		3	23	9		3	23	9		3	23	12	
4	23	13		4	23	13		4	23	12		4	23	14	
5	23	17		5	23	16		5	23	15		5	23	18	
6	23	20		6	23	20		6	23	19		6	23	21	
7	23	22		7	23	22		7	23	21		7	23	23	
8	23	24		8	23	24		8	23	23		8	23	25	
9	23	26		9	23	26		9	23	25		9	23	26	
10	23	27		10	23	27		10	23	26		10	23	27	
11	23	28		11	23	28		11	23	27		11	23	28	
12	23	28	Tropic.	12	23	28	Tropic.	12	23	28	Tropic.	12	23	28	
13	23	27		13	23	28		13	23	28		13	23	27	
14	23	26	Declination.	14	23	27	Declination.	14	23	27	Declination.	14	23	26	
15	23	25		15	23	26		15	23	26		15	23	24	
16	23	23		16	23	24		16	23	24		16	23	22	
17	23	21		17	23	21		17	23	22		17	23	20	
18	23	19		18	23	19		18	23	20		18	23	18	
19	23	15		19	23	16		19	23	17		19	23	14	
20	23	12		20	23	13		20	23	13		20	23	11	
21	23	8		21	23	9		21	23	10		21	23	6	
22	23	3		22	23	4		22	23	5		22	23	2	
23	22	58		23	23	0		23	23	1		23	22	59	
24	22	53		24	22	54		24	22	55		24	22	51	
25	22	47		25	22	48		25	22	50		25	22	45	
26	22	40		26	22	41		26	22	43		26	22	38	
27	22	33		27	22	34		27	22	36		27	22	31	
28	22	26		28	22	27		28	22	29		28	22	24	
29	22	18		29	22	20		29	22	22		29	22	16	
30	22	10		30	22	12		30	22	13		30	22	8	
31	22	0		31	22	4		31	22	6		31	22	59	

How to vse the Suns Declination, for knowing the eleuation of the Pole.

First learne whether the Sunne haue South Declination, or North Declination. Then marke the shadow he giueth, whether it shew towardes that Pole he is neerest, or to the contrarie.

If the Sun giue shadow, the same way that he is from the Equinoctial, he shall be betweene you and the Equinotiall, then take the meridian altitude, and subtract it from 90. vnto the rest, adioyne your Declination for the daie, the Sunne of both is the eleuation of the Pole, or your distance from the Equinoctiall.

But if the Sunne giue the shadow to the contrarie side of the Equinoctiall that he is in, (that is to say) the Sun in North Declination giue the shadow Southwards, or in South Declinations giue the shadow Northwards, then either the Equinoctiall shall be betweene you and the sun, or you in the Equinoctiall, or else you shall bee betweene the Equinoctial and the Sun, which you shall thus know.

Adde vnto your Meridian altitude of the Sunne, the Declination for the daie, if it amount to lesse then 90.d. so much as wanteth of 90.d. you shall be from the Quinoctiall that way that the shadow goeth.

But if it amount iust to 90.d. you shall be vnder the Equinoctiall. If it amount to more then 90.d. so much as is ouer and aboue 90.d. you shall be from the Equinoctiall towards the Sun, betweene the Equinoctiall and the sun.

And if at anie time you shall obserue the Suns altitude in your Zenith, then loke what declination it hath, and so much shall you be from the Equinoctiall, on the same side the Sun is in, but if he haue no Declination, then shall you shall be vnder the Equinoctiall line.

Prime.	Ianuarie.	Februarie.	March. Aprill.	May.	Iune.	Iulie.	August.	September	October.	November	December.
1	4	2	3	2	1 31	29	29	27	26	26	25	25
	3	12	22	7 ☽	16 2	14	3	19	12 ☽	6	1	5
	7	42	21	24	45 52	13	54	19	20	0	17	23
2	23	21	22	21	20	19	18	16	15	15	14	13
	3	14	23	8	15	00	10	22	☽12	5	0	19
	24	25	52	6	59	22	14	7	46	56	44	30
3	12	11	12	11	10	8	7	6	4	4	3	2
	12	3	17	0	8	16	23	8	18	8	0	18
	33	14	0	14	58	14	25	5	38	13	33	48
4	1 3 1		1	29	28	26	25	24	22	22	20	20
	14 8 ☽ 16		0	0	9	16	23	7	17	6	20	15
	8 4		28	32	17	21	31	47	16	36	22	4
5	19	18	19	18	17	16	15	14	12	11	10	9
	8 ☽	3	20	11	22	8	☽16	0	7	17	4	17
	48	30	35	22	53	19	40	30	10	33	39	55
6	8	7	8	7	7	5	5	3	2	1 30	29	28
	9 ☽	3	21	14	5	19	6	17	1	9 19	5	20
	48	7	22	22	40	6	14	27	10	50 7	14	48
7	27	25	27	26	25	24	24	22	21	20	18	18
	7	22	14	7	22	13	2	14	1	11	21	7
	20	45	48	5	48	12	46	19	13	17	36	13
8	16	15	15	14	13	12	12	10	9	9	7	6
	18	6	19	8	23	14	6	20	11	0	12	23
	38	5	0	56	15	50	4	53	4	18	17	40
9	5	3	5	3	3	1	1 30	29	28	27	26	26
	9	20	5	16	4	17	7 22	14	6	22	12	1
	36	0	51	44	22	0	9 17	15	33	6	24	10
10	24	22	24	22	22	20	20	18	17	17	15	15
	12	22	6	15	1	11	0	14	7	0	18	11
	5	0	54	51	14	54	25	53	14	42	26	10

Prime.	Ianuarie.	Februarie.	March.	Aprill.	May.	Iune.	Iulie.	August.	September	October.	November	December.
	14	12	13	12	11	9	9	7	6	6	4	4 0 0
11	1	13	23	8	15	24	8	19	8 ☽	0	21	22
	30	17	35	0	54	40	49	13	58	32	19	8 30
	3	2	2	1 30	29	27	27	25	24	23	22	11
12	8	0	☽13	0 8	16	23	7	☽16	4	19	13	8 56
	8	25	42	21 50	19	22	37	49	51	36	19	30
	21	19	21	19	19	17	16	15	13	13	11	11
13	3	21	11	23	9	16	23	7 ☽	16	2	16	8
	51	0	35	34	8	47	51	25	12	54	26	56
	10	8	10	9	8	7	6	5	3	2	1 30	30
	3	22	16	7	20	7	16	0	8	16	3 15	☽5
14	6	21	5	42	49	13	20	11	9	48	0 14	48
	18	27	29	28	27	26	25	24	22	21	20	19
15	22	16	9	2	16	4	15	0	9	18	4	15 ☽
	37	22	37	0	7	25	13	33	35	30	7	34
	18	16	17	16	15	14	13	12	10	10	8	8
16	4	18	10	2	18	9 ☽	23	12	23	10	20	6 ☽
	36	42	27	35	25	30	36	8	41	19	30	37
	6	5	6	5	4	3	3	1 3 1	29	29	27	27
17	17	4	15	5	20	10	1	16 7	21	10	22	9
	12	17	11	38	14	25	35	48 36	35	34	43	12
	25	24	25	24	23	22	21	20	19	18	17	16
18	19	5	15	2	14	3	18	9	2	☽18	9	23
	15	12	13	15	25	11	0	29	8	16	22	14
	15	14	5	13	13	11	10	9	8	7	4	6
19	11	2	6	☽15	0	9	21	10	2	19	13	7 8
	6	34	32	12	9	53	31	48	23	31	13	
									H			

A Table for 26. yeares, shewing the Prime, the Epact, and Dominicall Letter: And also what daie of the Moneth these moueable feasts falleth on. And heere alwaies ye shall note, that the Epact chaungeth the first daie of March, and the Prime and Dominicall Letter the first of Ianuarie: where you see two Dominicall Letters, that is leape yeare.

Anno Domini.	The Prime	The Epact.	Dominicall Letter	Easter daie.	Rogation Sundaie.	Ascention daie.	Whitsun daie.	Aduent Sundaie.
1581	5	25	A	26. March.	30. Aprill	4. Maie.	14. Maie.	3. Decemb.
1582	6	6	G	15. Aprill.	20. Maie.	24. May	3. Iune.	2. Decemb.
1583	7	17	F	31 March	5 Maie.	9 Maie	10 Maie	1 Decemb
1584	8	28	ED	19 Aprill	24 Maie	28 May	7 Iune	29 Nouēb
1585	9	9	C	11 Aprill	16 Maie	20 May	30 Maie	28 Nouēb
1586	10	20	B	3 Aprill	8 Maie	12 Maie	22 Maie	27 Nouēb
1587	11	1	A	16 Aprill	21 Maie	25 Maie	4 Iune	3 Decemb
1588	12	12	GF	7 Aprill	12 Maie	16 Maie	26 Maie	1 Decemb.
1589	13	23	E	30 March	4 Maie	8 Maie	18 Maie	30 Nouēb
1590	14	4	D	19 Aprill	24 Maie	28 Maie	7 Iune	29 Nouēb
1191	15	15	C	4 Aprill	9 Maie	13 Maie	23 Maie	28 Nouēb.
1592	16	26	BA	29 March	30 Aprill	4 Maie	14 Maie	3 Decemb.
1593	17	7	G	15 Aprill	20 Maie	24 Maie	3 Iune	2 Decemb
1594	18	18	F	31 March	5 Maie	9 Maie	19 Maie	1 Decemb
1595	19	29	E	20 Aprill	25 Maie	29 Maie	8 Iune	30 Nouēb
1596	1	11	DC	11 Aprili	16 Maie	20 Maie	30 Maie	28 Nouēb.
1597	2	22	B	27 March	1 Maie	5 Maie	15 Maie	27 Nouēb
1598	3	3	A	16 Aprill	21 Maie	25 Maie	4 Inne	3 Decemb
1599	4	14	G	8 Aprill	13 Maie	17 Maie	27 Maie	2 Decemb
1600	5	25	FE	23 March	27 Aprill	1 Maie	11 Maie	30 Nnuēb
1601	6	6	D	12 Aprill	17 Maie	21 Maie	31 Maie	29 Nouēb
1602	7	17	C	4 Aprill	9 Maie	13 Maie	23 Maie	28 Nouēb
1603	8	28	B	24 Aprill	29 Maie	2 Iune	12 Iune	27 Nouē
1604	9	9	AG	8 Aprill	13 Maie	17 Maie	27 Maie	2 Decemb
1605	10	20	F	31 March	5 Maie	9 Maie	19 Maie	1 Decemb
1606	11	1	E	20 Aprill	25 Maie	29 Maie	8 Iune	30 Nouēb

The contents of the Kalender following.

In the first and second colome, vnder the title daies, are the daies of the moneth, & dominicalletters, the third is of the feasts: the fourth colome sheweth howe manie houres and minutes the day containeth from Sun rising to Sun setting, the Pole being eleuated 52. degrées. The fifth colome of the 27. letters, serueth with the help of a Table following, to know what signe the Mone is in at all times.

How by the length of the day is knowen the length of the night, with the houre and miuute of the Sunnes rising and setting.

Deuide the length of the day, which you shall finde in the Kalender, into two parts equallie, the one halfe sheweth the houres and minutes of the Suns setting, the hours and minutes of the setting, being subtracted from 12. the remaine sheweth the houres and minutes of the rising: the whole arke or length of the day, beeing subtracted from 24. the rest sheweth the length of the night (that is to say) from Sunne setting to Sun rising.

As for example.

The 15. of January, I find in the Kalender the length of the day to be 8. houres. 30. minutes, which beeing deuided the halfe thereof is 4. houres 15. minutes, the Sunnes setting that day: this 4. houres 15. minutes, subtracted from 12. resteth 7. houres, 45. minutes, which is the hour of the Sunnes rising: subtract 8. houres 30. minutes, the whole length of the day, out of 24. rest 15. houres, 30. minutes, which is the length of the night that day of the moneth.

Daies.		Ianuarie.	Length of the daie.			Daies.		Februarie.	Length of the Daie.		
1	A	New yeres day.	7	25	i	1	d	Fast.	9	28	h
2	b	Octa. Stephen.	7	55	k	2	e	Purifi. of Mary.	9	32	k
3	c	Octa. John.	7	58	l	3	f	Blase. Martyr.	9	36	l
4	d	Octa Innocēt.	8	0	m	4	g	Gilbert confes.	9	40	m
5	e	Depo. of Edw	8	3	n	5	A	Agathe virgin.	9	44	n
6	f	Twelfth daye.	8	6	o	6	b	Dorothe virg.	9	48	o
7	g	Felix & Janu.	8	8	p	7	c	Angulle.	9	52	p
8	A	Lucian Priest.	8	11	q	8	d	Sallamon.	9	56	q
9	b	Joyce Virgin	8	14	r	9	e	Sun in pisces.	10	0	r
10	c		8	16	s	10	f	Scollastica.	10	4	s
11	d	Sol in Aquaris	8	18	t	11	g	Sother bishop.	10	8	t
12	e	Atlas.	8	20	v	12	A	Eufrase virgin	10	10	v
13	f	Hillarie Bish.	8	24	u	13	b		10	14	u
14	g	Felicia.	8	26	x	14	c	Valentine.	10	18	x
15	A	Maurice.	8	30	y	15	d		10	22	y
16	b	Marcell.	8	32	z	16	e	Julian virgin.	10	26	z
17	c	Depo. of Anth.	8	36	&	17	f	Germaine.	10	32	&
18	d	Prisca Virgin.	8	40	A	18	g	Hugh Bishop.	10	30	A
19	e	Wolstane bish.	8	42	B	19	A	Simeon.	10	38	B
20	f	Fabian & Seb.	8	46	C	20	b	Mildred.	10	42	C
21	g	Agnes Virgin.	8	50	D	21	c	Lyric. Martirs	10	46	D
22	A	Vincent mart.	8	52	E	22	d	Peters chaires	10	50	E
23	b	Timothe	8	56	F	23	e	Fast.	10	54	F
24	c	Emerice.	9	0	G	24	f	Mathie Apost.	10	58	G
25	d	Conu of Paul.	9	4	H	25	g	Inuent. Paule.	11	2	H
26	e	Policarp. mar.	9	6	I	26	A	Nestor.	11	7	I
27	f	Chrisost. doctor	9	10	K	27	b	Alexander.	11	12	K
28	g	Theodor priest.	9	14	L	28	c	Augustine.	11	16	L
29	A	Valerie bishop.	9	18	M						
30	b	Bateld quéene.	9	22	N						
31	c	Saturn & Vice.	9	26	O						

Daies.		March.	Length of the daie.			Daies.		Aprill.	Length of the daie.		
1	b	Dauid.	11	24	f	1	g	Gilbard.	13	30	k
2	c	Chadde.	11	28	g	2	a	Marie Egypt.	13	34	l
3	d	Maurice.	11	32	h	3	b	Richard Bish.	13	38	m
4	e	Adrian.	11	36	i	4	c	Ambrose.	13	42	n
5	f	Focas & Euse.	11	40	k	5	d	Vincent.	13	46	o
6	g	Viet & Venin.	11	44	l	6	e	Sextus.	13	50	p
7	A	Perpetu.	11	48	m	7	f	Euphemie.	13	52	q
8	b	Depo. of Felix	11	52	n	8	g	Dionisies.	13	56	r
9	c	Forty martirs	11	56	o	9	A	Perpetuus.	14	0	s
10	d	Agapit.	12	0	p	10	b	Apolinia.	14	2	t
11	e	Sunne in Aries	12	4	q	11	c	Sun in Taurus.	14	4	v
12	f	Gregorie Bish	12	8	r	12	d	Sother.	14	8	u
13	g	Theodor.	12	12	s	13	e	Marcus.	14	12	x
14	A	Candide.	12	16	t	14	f	Tiburtie.	14	16	y
15	b	Longine.	12	20	v	15	g	Osmond.	14	20	z
16	c	Hilla & Jonase	12	24	u	16	A	Isidorie.	14	24	&
17	d	Gertude.	12	28	x	17	b	Anisette.	14	28	A
18	e	Edward king.	12	32	y	18	c	Eleutherius.	14	32	B
19	f	Jose. Ma. hus.	12	46	z	19	d	Alphege.	14	34	C
20	g	Cuthburt.	12	40	&	20	e	Victor.	14	38	D
21	A	Benedict.	12	44	A	21	f	Simion.	14	42	E
22	b	Afrodose.	12	48	B	22	g	Sother.	14	46	F
23	c	Theodore.	12	54	C	23	A	George Mart.	14	50	G
24	d	Fast.	12	58	D	24	b	Wilfride.	14	54	H
25	e	Annũ. of Mary	12	2	E	25	c	Marke Euang.	14	56	I
26	f	Fast or martyr	13	6	F	26	d	Clete.	15	0	K
27	g	Mercianie.	13	10	G	27	e	Anastatius.	15	4	L
28	A	Rupert.	13	14	H	28	f	Vitales.	15	8	M
29	b	Victorine.	13	18	I	29	g	Peter of Mala.	15	10	N
30	c	Quirine.	13	22	K	30	A	Dep. of Erken	15	14	O
31	d	Adelme.	13	26	L	31					

Daies.		Maie.	Length of the daie.			Daies.		Iune.	Length of the Daie.		
1	b	Philip & Iacob	15	18	n	1	e	Nichomede.	16	24	:
2	c	Athanasius.	15	20	o	2	f	Marcell.	16	25	a
3	d	Inu. of ỳ crosse	15	24	p	3	g	Erasmus.	16	26	b
4	e	Thristopher.	15	28	q	4	A	Petrocus.	16	27	c
5	f	Godarde.	15	29	r	5	b	Boniface.	16	28	d
6	g	John port Lat.	15	30	s	6	c	Melon.	16	28	e
7	A	John of Beuer	15	34	t	7	d	Paule Bishop.	16	29	f
8	b	Aper. of Micha	15	36	u	8	e	Trãs. of Edm.	16	30	g
9	c	Trans. of Nic.	15	40	x	9	f	Janua. confess.	16	30	A
10	d	Gordian.	15	42	y	10	g	Trã. of Wolst	16	30	b
11	e	Anthony.	15	44	z	11	A	Barnard Apo.	16	30	c
12	f	Sun in Gemini.	15	46	&	12	b	Sun in Cancer.	16	30	d
13	g	Seruasius.	15	49	;	13	c	Anthonie.	16	30	e
14	A	Boniface mart	15	52	ſt	14	d	Basilides.	16	30	f
15	b	Isidore.	15	54	a	15	e	Vice & Mode.	16	29	g
16	c	Discor. mart.	15	57	b	16	f	Tran. of Rich.	16	28	A
17	d	Dunstane.	15	0	c	17	g	Botulphe.	16	28	b
18	e	Bernardine.	16	2	d	18	A	Mar. & Marcel	16	27	c
19	f	Aquilla.	16	5	e	19	b	Gerualsius.	16	27	d
20	g	Dunston.	16	8	f	20	c	Tran. of Edw.	16	26	e
21	A	Barnardine	16	10	g	21	d	Malburge.	16	25	f
22	b	Helena quéene	16	12	h	22	e	Albane.	16	24	g
23	c	Desiderj.	16	14	i	23	f	Fast.	16	23	A
24	d	Serule.	16	15	k	24	g	Iohn Baptist.	16	22	b
25	e	Urbane.	16	16	l	25	A	Amaudi.	16	20	c
26	f	Adelme confess	16	18	m	26	b	John & Paule.	16	19	d
27	g	Bede Priest.	16	19	n	27	c	Thrsence.	16	18	e
28	A	Germaine.	16	20	o	28	d	Fast.	16	16	f
29	b	Cosone.	16	21	p	29	e	Peter & Paule.	16	15	g
30	c	Felix.	16	22	q	30		Com. of Paule	16	14	A
31	d	Petronill.	16	23	r						

Daies.		Iulie.	Length of the daie.			Daies.		Auguſt.	Length of the daie.		
1	b	Octa of Iohn.	16	12	t	1	c	Lamas.	14	46	y
2	c	Viſit of Marie.	16	10	v	2	d	Stephen.	14	42	z
3	d	Trã of Thom.	16	8	u	3	e	Inuent. Sept.	14	38	ꝛ
4	e	Tran. of Mart	16	5	x	4	f	Iuſtine.	14	34	ſt
5	f	CCC virgins.	16	3	y	5	g	Feſtũ Niuis.	14	32	a
6	g	Martalis.	16	2	z	6	A	Trãſſi. of Chr.	14	28	b
7	A	Zenane mart.	16	0	ꝛ	7	b	Feaſt of Ieſus.	14	24	c
8	b	Depo. of Grem	15	57	ſt	8	c	Ciriacke.	14	20	d
9	c	Cyrile Biſhop	15	54	a	9	d	Roman Mart.	14	16	e
10	d	Dog dais begin	15	52	b	10	e	Laurence mar	14	12	f
11	e	Seuen brethrẽ	15	49	c	11	f	Cutbert.	14	8	g
12	f	Nabor & Felix.	15	46	d	12	g	Clarie.	14	4	h
13	g	Sunne in Leo.	15	44	e	13	A	Hiplit.	14	0	i
14	A	Reuell.	15	42	f	14	b	Sun in Virgo.	14	56	k
15	b	Tranſl. Suite.	15	40	g	15	c	Aſſump. Marie	13	52	l
16	c	Trãſl. Oſmõd.	15	36	h	16	d	Roch Mart.	13	50	m
17	d	Katherine.	15	34	i	17	e	Octa. Laurẽce	13	46	n
18	e	Arnulfe.	15	30	k	18	f	Leus.	13	42	o
19	f	Rufian & Iuſt.	15	28	l	19	g	Bernerd.	13	38	p
20	g	Margaret.	15	24	m	20	A	Dog daies end.	13	34	q
21	A	Parede.	15	20	n	21	b	Priuate.	13	30	r
22	b	Marie Magde.	15	18	o	22	c	Timothe.	13	26	s
23	c	Apolinaries.	15	14	p	23	d	Faſt.	13	22	ſt
24	d	Faſt	15	10	q	24	e	Barthel Apoſt.	13	18	t
25	e	Iames Apoſtle	15	8	r	25	f	Lewes king	13	14	v
26	f	Anne mot Ma.	15	4	s	26	g	Seuerne.	13	10	u
27	g	Vii. Sleepers.	15	0	ſt	27	A	Rufine martir.	13	8	x
28	A	Sampſon.	14	58	t	28	b	Auguſtine biſh	13	6	y
29	b	Martha.	14	56	v	29	c	John beheded.	13	2	z
30	c	Abdon & Sen.	14	54	u	30	d	Felix & Audas.	12	58	ꝛ
31	d	German.	14	50		31	e	Cutburt.	12	54	ſt

Daies.		September.	Length of the daie.		
1	f	Giles.	12	48	a
2	g	Anthony mar.	12	44	b
3	A	Lupus Bishop	12	40	c
4	b	Transl. Cuthb.	12	36	d
5	c	Bertine.	12	32	e
6	d	Eugenius.	12	28	f
7	e	Nati. Eliz. Reg.	12	24	g
8	f	Natiu. of Mary	12	20	h
9	g	Gorgonie.	12	16	i
10	A	Siluius Bish.	12	12	k
11	b	Protec, & Hist.	12	8	l
12	c	Martinian.	12	4	m
13	d	Sunne in Libra	12	0	n
14	e	Holie Crosse.	11	56	o
15	f	Philetus.	11	52	p
16	g	Edith.	11	48	q
17	A	Lambert.	11	44	r
18	b	Vict. and Cor.	11	40	s
19	c	Januarie mar.	11	36	t
20	d	Fast.	11	32	v
21	e	Mathew Apo.	11	28	u
22	f	Maricius	11	24	x
23	g	Tecla virgin.	11	20	y
24	A	Andochius.	11	16	z
25	b	Fermine.	11	12	&
26	c	Sipri & Just.	11	6	ſt
27	d	Cosme & Da.	11	2	a
28	e	Eruperius.	10	58	b
29	f	Michael Arch.	10	54	c
30	g	Hierome priest	10	50	d

Daies.		October.	Length of the daie.		
1	A	Remigius.	10	46	e
2	b	Leodegarie.	10	24	f
3	c	Candide.	10	38	g
4	d	Fraunces.	10	34	h
5	e	Apoline.	10	30	i
6	f	Faith.	10	26	k
7	g	Martine.	10	22	l
8	A	Pellagius.	10	28	m
9	b	Gereon & Vic.	10	14	n
10	c	Nicasius.	10	10	o
11	d	Edward king.	10	8	p
12	e	Adrian.	10	4	q
13	f	Calistes.	10	0	r
14	g	Sun in Scorpio	9	56	s
15	A	Wolfran.	9	52	ſ
16	b	Mich. of ỹmoũt	9	48	t
17	c	Etheldred.	9	44	v
18	d	Luke Euangel.	9	40	u
19	e	Fredeswide.	9	36	x
20	f	Austerbert.	9	32	y
21	g	xi. M. virgins.	9	28	z
22	A	Mary Salamõ	9	26	&
23	b	Romaine.	9	22	ſt
24	c	Magloire.	9	18	a
25	d	Crispine.	9	14	b
26	e	Ursula.	9	10	c
27	f	Fast.	9	6	d
28	g	Simon & Iude.	9	4	e
29	A	Narsisus.	9	0	f
30	b	German.	8	56	g
31	c	Fast.	8	52	A

Daies.		Nouember.	Length of the daie.			Daies.		December.	Length of the daie.		
1	d	All Saints.	8	50	g	1	f	Elegius.	7	36	l
2	e	All Soules.	8	46	a	2	g	Libane.	7	35	m
3	f	Wenefride.	8	42	b	3	A	Dep. Osmond.	7	34	n
4	g	Amantius.	8	40	c	4	b	Barbara.	7	33	o
5	A	Lete Priest.	8	36	d	5	c	Sana.	7	32	p
6	b	Leonard.	8	32	e	6	d	Nicholas bish.	7	32	q
7	c	Wilbrode.	8	30	f	7	e	Ambrose.	7	31	r
8	d	Feure crowne	8	26	g	8	f	Conc. of Marie	7	30	s
9	e	Theodore.	8	24	A	9	g	Cipian.	7	30	t
10	f	Benet.	8	20	b	10	A	Eulalia.	7	30	u
11	g	Martine Bish.	8	18	c	11	b	Damase.	7	30	u
12	A	Paterne.	8	16	d	12	c	Sun in Capric.	7	30	u
13	b	Sunne in Sagit.	8	14	e	13	d	Lucie virgin.	7	30	x
14	c	Transl. Erken	8	11	f	14	e	Nicasius bish.	7	30	y
15	d	Machute.	8	8	g	15	f	Valerius.	7	31	z
16	e	Dep. Edmond	8	6	A	16	g	Lazarus confe.	7	32	&
17	f	Init. Reg. Eliz.	8	3	b	17	A	Dsapientie.	7	32	ſt
18	g	Octa Marie.	8	0	c	18	b	Gracian.	7	33	a
19	A	Eliza Martyr.	7	58	d	19	c	Uenesia virg.	7	34	b
20	b	Edmond king.	7	55	e	20	d	Fast.	7	35	c
21	c	Present. Mary.	7	52	f	21	e	Thomas Apo.	7	36	d
22	d	Cecil virgin.	7	50	g	22	f	xxx. Martirs.	7	37	e
23	e	Clement.	7	47	A	23	g	Victor.	7	38	f
24	f	Grisogon.	7	45	b	24	A	Fast.	7	40	g
25	g	Katherine.	7	44	c	25	b	Christmasdaie.	7	41	h
26	A	Line.	7	42	d	26	c	Stephen martir	7	42	i
27	b	Agricola.	7	41	e	27	d	Iohn Euangell.	7	44	k
28	c	Rufus martir.	7	40	f	28	e	Innocents daie.	7	45	l
29	d	Satu. Fast	7	38	g	29	f		7	42	m
30	e	Andrew Apo.	7	37	A	30	g	Trã. of Iames	7	48	n
						31	A	Siluester.	7	50	o

A Table wherein is shewed at all times, what signe the Moone shal be in, by the Prime & helpe of the letters in the last Colome of the Kalender, as by example is heereafter shewed.

The Prime.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Aries.	y	n	c	v	l	st	s	h	z	p	e	u	m	a	s	i	⁊	q	f
Aries.	z	o	d	u	m	a	s	i	⁊	q	f	x	n	b	t	k	st	r	g
Aries.	⁊	p	e	x	n	b	t	k	st	r	g	y	o	c	v	l	a	s	h
Taurus.	st	q	f	y	o	c	v	l	a	s	h	z	p	d	u	m	b	s	i
Taurus.	a	r	g	z	p	d	u	m	b	s	i	⁊	q	e	x	m	c	t	k
Gemini.	b	s	h	⁊	q	e	x	n	c	t	k	st	r	f	y	o	d	v	l
Gemini.	c	s	i	st	r	f	y	o	d	v	l	a	s	g	z	p	e	u	m
Cancer	d	t	k	a	s	g	z	p	e	u	m	b	s	h	⁊	q	f	x	n
Cancer	e	v	l	b	s	h	⁊	q	f	x	n	c	t	i	st	r	g	y	o
Leo.	f	u	m	c	t	i	st	r	g	y	o	d	v	k	a	s	h	z	p
Leo.	g	x	n	d	v	k	a	s	h	z	p	e	u	l	b	s	i	⁊	q
Leo	h	y	o	e	u	l	b	s	i	⁊	q	f	x	m	c	t	k	st	r
Virgo.	i	z	p	f	x	m	c	t	k	st	r	g	y	n	d	u	l	a	s
Virgo	k	⁊	q	g	y	n	d	v	l	a	s	h	z	o	e	u	m	b	s
Libra.	l	st	r	h	z	o	e	u	m	b	s	i	⁊	p	f	x	n	c	t
Libra.	m	a	s	i	⁊	p	f	x	n	c	t	k	st	q	g	y	o	d	v
Scorpio	n	b	s	k	st	q	g	y	o	d	v	l	a	r	h	z	p	e	u
Scorpio	o	c	t	l	a	r	h	z	p	e	u	m	b	s	i	⁊	o	f	x
Sagittarius	p	d	v	m	b	s	i	⁊	q	f	x	n	c	s	k	st	r	g	y
Sagittarius.	q	e	u	n	c	s	k	st	r	g	y	o	d	t	l	a	s	h	z
Sagittarius.	r	f	x	o	d	t	l	a	s	h	z	p	e	v	m	b	s	i	⁊
Capricorne	s	g	y	p	e	v	m	b	s	i	⁊	q	f	u	n	c	t	k	st
Capricorne.	s	h	z	q	f	u	n	c	t	k	st	r	g	x	o	d	v	l	a
Aquarius.	t	i	⁊	r	g	x	o	d	v	l	a	s	h	y	p	e	u	m	b
Aquarius.	v	k	st	s	h	y	p	e	u	m	b	s	i	z	q	f	x	n	c
Pisces.	u	l	a	s	i	z	q	f	x	n	c	t	k	⁊	r	g	y	o	d
Pisces.	x	m	b	t	k	⁊	r	g	y	o	d	v	l	st	s	h	z	p	e
Pisces.	y	n	c	v	l	st	s	h	z	p	e	x	m	a	s	i	⁊	q	f

The vſe of the Table.

FIrſt goe to the Kalender, to the daie of the moneth which ye deſire to know what ſign the Moone is in: And in the laſt colome of that month vnder the Moone, in the head therof, directly againſt the ſame day, you ſhall find one of the 24. letters, which you ſhall beare in memorie, and returne to the Prime of the preſent yéere, in the head of this Table, deſcending downe by the Colome of the ſame Prime, vntill ye finde the letter ye beare in memorie, of the Kalender, and directlie againſt this ſquare, or letter in the firſt Colome yee ſhall finde named the ſigne that the Moone then occupieth.

As for example.

The yeare 1581. the 12. of June, I deſire to know what ſigne the Moone is in, I goe to the Kalender to that Moneth of June to the 12. day, againſt which, in the laſt Colome, vnder the Moone, in the head of the moneth I finde the letter a, which bearing in memorie, I returne to this Table, to the Prime of this yeare, which I ſéeke in the table of the mœueable feaſts, and find to be 5. where I enter the Table, in the head, and in the firſt Colome, deſcending downe, vntill I finde (a) againſt which to the left hand, in the firſt Colome, I find Scorpio, which ſheweth the moon to be in that ſigne.

THE CONTENTS

Of this Booke.

The first Chapter.

OF the Magnes or Loadstone, where they are found, and of their colours, weight, and vertue in drawing yron or steele, and of other properties of the same Stone.

The second Chapter.

Of the diuerse opinions of those that haue written of the Attractiue point, and where they haue imagined it to be.

The third Chapter.

By what meanes the rare and straunge Declining of the Needle, from the plaine of the Horizon was first found.

The fourth Chapter.

How to finde the greatest Declining of the Needle vnder the Horizon.

The fifth Chapter.

That in the vertue of the Magnes or Loadstone, is no pondrous or waightie matter, to cause anie such Declinig in the Needle.

The sixt Chapter.

A confutation of the common receiued opinion of the point Attractiue.

The seuenth Chapter.

Of the point Respectiue, where it may bee by greatest reason imagined.

The

The eight Chapter.

Certaine proofes of the power and action, wholie and freelie beeing in this Stone, to shewe this point Respectiue and in the Needle, by vertue and power receiued of the stone, and not forced, or constrained by anie Attractiue in Heauen or Earth.

The ninth Chapter.

Of the Variation of the Needle, from the Pole or Axeltree of the Earth, and how it is to be vnderstood.

The tenth Chapter.

Of the common Compasses, and of the diuerse different sortes and makings of them, with the inconueniences that may grow by them, and the Plats made by them.

A Table or Regiment of the Sunnes Declination, exactlie calculated vnto the minute by the true place of the Sunne, whose greatest Declination for this age is 23. degrees 28. minutes, & may serue for 30. yeeres without great errour.

How to vse the Sunnes Declination, for knowing the eleuation of the Pole.

Three Tables, the first sheweth the coniunctions of the Sunne and Moone for 19. yeares, with the Eclipses of the Sunne.

The second Table sheweth the houre and minute of the oppositions or full Moones, with the Eclipses of the Moone.

The third Table followeth the Kalender, by the which

is alwaies found what ſigne the Moone is in, with the helpe of the letters in the Kalender, alſo by the ſaid Kalender is ſhewed the houre and minute of the length of the day, for euery daie of the yeare, for the eleuation of the Pole 52. degrees.

A Table to know what Planet rules anie houre either by day or night.

A Table to know the length of the Planitarie hour, from the ſhorteſt day and longeſt night, till the longeſt day and ſhorteſt night.

A Chapter of the longitude and declination of 32. notable fixed ſtarres very neceſſarie for Nauigation, with Tables of their ſhining, and at what point of your Compaſſe they doo both riſe and ſet: and alſo Tables for euerie Moneth of the yeare, declaring at what houre and minute they be South, running from the firſt daie of the moneth, to the fifteenth, and from the fifteenth to the laſt daie, and will continue theſe 100. yeeres without much error.

A Table to know the riſing and ſetting of theſe ſtarres, by what point of the Compaſſe, & how many houres they be aboue our Horizon, the Pole being raiſed 51. or 52. degrees.

A Table of the fixed Starres.
A Table of the true place of the Sunne.
The Table of the Equation of the Sunne.
The Chapter of the Declination of the Sunne.

A Table to knowe what Planet rules anie houre, either of daie or night for euer.

Blundevill Spheare l.1.c.54

Gouernors of the daie.	Sundaie.	Mundaie.	Tuedsaie.	Wednesday	Thursdaie.	Fridaie.	Saturdaie.	Rulers of the night.
Sol.	1	12	9	0	10	0	11	Iupiter.
Venus	2	0	10	0	11	1	12	Mars.
Mercurie.	3	0	11	1	12	2	0	Sol.
Luna.	4	1	12	2	0	3	0	Venus.
Saturne.	5	2	0	3	0	4	1	Mercurie.
Iupiter.	6	3	0	4	1	5	2	Luna.
Mars.	7	4	1	5	2	6	3	Saturne.
Sol.	8	5	2	6	3	7	4	Iupiter.
Venus.	9	6	3	7	4	8	5	Mars.
Mercurie.	10	7	4	8	5	9	6	Sol.
Luna.	11	8	5	9	6	10	7	Venus.
Saturne.	12	9	6	10	7	11	8	Mercurie
Iupiter.	0	10	7	11	8	12	9	Luna.
Mars.	0	11	8	12	9	0	10	Saturne.

The vse of this Table is thus.

VNder the daie of your requeſt, ſeeke the houre that ye deſire, then on the left ſide right there againſt ſhal ye ſée the Planet that gouernes that houre by daie, and at the right ſide, the Planet that rules it by night, as thus. On Thurſdaie the thirde houre of the daie rules ☉ and the 8. houre of the night gouernes ☽. and ſo of the reſt, for it is plaine enough.

A Table to know the length of the planetarie houre, from the ſhorteſt daie and longeſt night, till the longeſt day & ſhorteſt night.

M	0	12	24	36	48
H	H.M.	H.M	H.M.	H.M.	H.M.
7	0. 35	0. 36	0. 37	0. 38	0. 39
8	0. 40	0. 41	0. 42	0. 43	0. 44
9	0. 45	0. 46	0. 47	0. 48	0. 49
10	0. 50	0. 51	0. 52	0. 53	0. 54
11	0. 55	0. 56	0. 57	0. 58	0. 59
12	1. 0	1. 1	1. 2	1. 3	1. 4
13	1. 50	1. 6	1. 7	1. 8	1. 9
14	1. 29	1. 11	1. 12	1. 13	1. 14
15	1. 25	1. 16	1. 17	1. 18	1. 19
16	1. 20	1. 21	1. 22	1. 23	1. 24
17	1. 20	1. 26	1. 27	1. 28	1. 29

The vſe is this.

Know the length of the day or night, that ye require by the Table proceeding in houres & minutes, and therewith enter this Table, the houre at the ſide, and the neereſt minute at the head, and then diſcend right againſt your hour and there in the common angle ſhal ye finde the houre and minute, or minutes onely that the Planet raignes by the houres of the clocks.

As for example.

The 12. of June the daie is 16. houres, 20. minutes, wherwith I enter this Table as is ſhewed, and in the angle I find 1. houre 22. minutes, which ſheweth that a planet that day rules an houre & a quarter, and 7. min. of the clocks. Alſo for the ſame night I find it to be but 7. houres 40. minuts, where with I enter into this table with 7. at the ſide, 36. at the head (for that is neereſt) and in the common angle I finde but onelie 38. minutes, which ſhewe that a Planet in that night rules but halfe an houre and 8 minutes of the clockes, and ſo of the reſt.

The Chapter is of the longitude, and the declination of 32 notable fixed ſtars, very neceſſary for Nauigatiõ, with tables of their ſhining, and at what point of your Compaſſe they do both riſe and ſet: and alſo Tables for euery moneth of the yeare, declaring at what houre and minute they be South, running from the firſt daie of the Moneth, to the fifteenth: and from the fifteenth to the laſt daie, and will continue theſe 100. yeares without much errour.

I Doe thinke it conuenient for diuerſe conſiderations, to ſhew the longitude and declination of certaine of the moſt notableſt fixed Starres that are neere vnto the Equinoctiall, to the number of 32. of them which are verie neceſſarie for Nauigation in diuerſe reſpects, as this: If you be vnto the North partes, where the North Pole is raiſed more then 50. or 60. degrées, then the North Starre is too high to be obſerued or taken with the croſſe Staffe (as Maiſter Bourne hath declared in his firſt Chapter of his Regiment for the Sea) and it may chance ſo, that in the day the Sun is not to be ſéene at noone, and then theſe Starres may ſerue your turne.

If the pole be raiſed more then 50. or 60. degrees, it is to high to be obſerued by the croſſe ſtaffe

And furthermore, they be verie good for them that haue occaſion to trauaile beyond the Equinoctiall, where the North Pole is vnder the Horizon, in vſing their declination as they doe the Sunnes declination in all points (as doth appeare in the 7. 8. and 9. Chapters of M. Bournes Regiment.) And moreouer, they bee verie neceſſarie for Sea fairing men to knowe the houres of the night, both by their being vpon the Meridian, and alſo by their riſing and ſetting, you may knowe the true time of their riſing

These ſtars will ſerue beyond the Equinoctial

and setting, you may knowe the true time of their rising and setting in euerie latitude by their declination from the Equinoctial, whether they decline to the South parts or North partes (as is declared by the declination of the Sunne in the 11. Chapter of M. Bournes Regiment.)

The order of the Table following

And furthermore, by anie of these Starres you maie trie the Variation of your Compasse by night, &c. Nowe shall followe the Table of all these Starres. The first rowe of this Table containeth the names of the starres: The second the signes, what they bee in longitude: The third, the degrees in the signes: The fourth, the minutes belonging thereunto: The fift, the degrees of declination: The sixt, the odde minutes belonging thereunto. The seauenth sheweth toward what place they decline, by Letters, of which S. signifieth the Septentrional, or north declination. M. signifieth Meridionall, or south declination, as in the Table doth appeare. The eight doth shewe nothing but the bignesse of the Starres. Now followeth the Table.

A table of the fixed Starres.

The names of the Starres.	Signes	Longit. deg.mi	Decli- leg.mi.	To what part they decline.	Bignes of the Stars.
Whales backe.	Aries.	6. 6	12.11	M	second bignesse.
Whales bellie.	Aries.	16. 2	12.20	M	second bignesse.
Rammes horne.	Aries,	27.42	17.19	S	third bignesse.
Rammes head.	Taurus.	1. 46	21.16	S	third bignesse.
Bulles eie.	Gemini.	3. 42	15.42	S	great starres.
Orions left foot.	Gemini.	10.12	9. 14	M	a great starre.
Orions left shoulder.	Gemini.	11.26	4. 37	S	a starre of the
First Orions girdle.	Gemini.	16.22	1. 19	M	second light both.
Orions right shoulders.	Gemini.	23. 6	6. 18	S	a great starre.
Great dogge.	Cancer.	8. 40	15.30	M	a very great star.
Lesser dogge.	Cancer.	20 10	6. 4	S	a great starre.
Brightest in Hydra.	Leo.	21. 2	4. 47	M	second bignesse.
Lions necke.	Leo.	23.16	21.59	S	second bignesse.
Lions heart.	Leo.	23.32	14. 3	S	a great starre.
Lions backe.	Virgo.	5. 16	22.30	S	second bignesse.
Lions taile.	Virgo.	15.32	16 46	S	a great starre.
Rauens head.	Libra.	5. 6	19.53	M	of ỹ third bignes.
Rauens wing.	Libra.	9. 36	17. 8	M	both those.
Virgines spike.	Libra.	17.42	4. 54	M	a great starre.
Twirtbots thighs.	Libra.	18. 6	22. 9	S	a great starre.
South ballance.	Scorpio	9. 2	13.44	M	second bignesse.
North ballance.	Scorpio.	13.12	7. 33	M	second bignesse.
Scorpions heart.	Sagit.	3.42.	24.47	M	second bignesse.
Hercules head.	Sagit.	8. 42	15.20	S	third bignesse.
Serpents head.	Sagit.	15.52	14. 7	S	third bignesse.
The Eagle.	Capric.	24.51	7. 28	S	second bignesse.
Dolphins taile.	Aquar.	8. 27	10. 1	S	third bignesse.
Goates taile.	Aquar.	17.22	14.13	M	third bignesse.
Water pourers leg.	Pisces.	2. 20	15.52	M	third bignesse.
Pegasus shoulder.	Pisces.	17. 4	13 1	S	second bignesse.
Pegasus legge.	Pisces.	23.10	26.30	S	second bignesse.
Whales taile.	Pisces.	26.21	21 47	M	third bignesse.

The vse of this Table is this : when you haue taken the height of anie of these starres vpon the Meridian, then looke what declination the Starre hath from the Equinoctiall: If the Starre hath North declination, then subtract or take awaye the Starres declination from the height: If it hath South declination, then adde or put vnto the height, the Starres declination, and that will shew vnto you the height of the Equinoctiall, and then by the height of the Equinoctiall, the height of the Pole is knowen, as Master Bourne hath declared in the 7. Chapter of the Regiment for the Sea. And nowe I thinke it conuenient to make a certaine Table, to shewe vnto you at what houre and time any of these Stars be vpon the meridian, whereby they may the better knowe these Starres. I will also shew vnto you howe long anie of these Starres doe shine or tarrie aboue the Horizon in this Latitude from the Equinoctiall of London, that is at 51. or 52. degrees. And also at what point of the Compasse anie of these Stars doe rise or set, which will serue this 100. yeares without much errour.

How to vse the stars declination to know the height of the Pole.

A Table to know the rising and setting of these Starres, by what point of the Compasse, & how many houres they be aboue our Horizon, the pole beeing raised 51. or 52 degrees.

The Whales backe riseth East and by South, and vnto the Southwards: and shineth 10. hours & better

The Whales belly (in a manner) as the Whales backe.

The Rams horne riseth East Northeast, and setteth West Northwest: and shineth 15. houres 16. minutes.

The Rannes head riseth East Northeast, and setteth West northwest: and shineth 16. houres. 4. minutes.

The Buls eie riseth neere the East Northeast, and setteth neere the West Northwest, and shineth 15. houres. 2 minutes.

The Orions left foot riseth neere the East and by south and setteth neere the West and by South, and shineth 10 houres

houres and 6. minutes.

The Orions left shoulder riseth East and to the northwards, and setteth West and to the Northwards, and shineth 11. houres 45. minutes.

The first in Orions girdle doth rise a little to the Southwards of the East, and setteth a litle to the Southwards of the West, and shineth 11. houres 46. minutes.

Orions right shoulder riseth East, and vnto the northwards, and setteth West and vnto the Northwards: and shineth 13. houres 12. minutes.

The great dog riseth East Southeast, and setteth west Southwest, and shineth 9. houres.

The lesser dog riseth East and vnto the Northwardes, and setteth West and vnto Northwards, and shineth 13. houres 10. minutes.

The brightest in Hydra riseth East and vnto the southward, and setteth West and vnto Southwardes, and shineth 11. houres and 7. minutes.

The Lions necke riseth East Northeast, and to the Northwards, and setteth west Northwest, & to the northwards, and shineth 16. houres 16. minutes.

The Lions heart riseth nére the East Northeast, and setteth nére the West Northwest, and shineth 14 hours 50. minutes.

The Lions backe riseth nére the Northeast and by East, and setteth nére the Northwest and by West, and shineth 16. houres 26. minutes.

The Lions taile riseth nére the East Northeast, and settteth nére the West Northwest, and shineth 15. hours 12. minutes.

The Rauens head riseth nére the East Southeast, and setteth nére the West Southwest, and shineth 8. houres 12. minutes.

The Rauens wing riseth nére the East Southeast, and setteth nére the west southwest, and shineth 8. hours 50. minutes.

The virgins spike riseth East and to the Southwards, and setteth West and to the Southwards, and shineth 11 houres 4. minutes.

Betwéne bots thighs, riseth néere the Northeast and by East, and setteth néere the Northwest, and by West, and shineth 16. houres 20. minutes.

The South balance riseth néere the East Southeast, and setteth néere the West Southwest: and shineth 9. houres 36. minutes.

The North balance riseth néere the East and by south and setteth néere the West and by South, and shineth 10. houres 38. minutes.

The Scorpions heart riseth néere the Southeast and by east, and setteth néere the southwest and by west, and shineth 7. houres 5. minutes.

Hercules head riseth néere the East Northeast, and setteth néere the West Northwest, and shineth 14. houres. 56 minutes.

The Serpents head riseth néere the East Northeast, and setteth néere the West Northwest, and shineth 14. houres 40. minutes.

The Eagle riseth néere the East and by North, and setteth néere the West and by North, & shineth 13. houres 24. minutes.

The 11. Chapter of M Bournes Regiment for the Sea, will shewe how long any of these starres will shine in all places.

The Dolphines taile riseth East and by North, and setteth West and by North, and shineth 15. houres 57. minutes.

The Goats taile riseth néere the East Southeast, and setteth West Southwest, and shineth 9. houres 20. minutes.

The Water powzers leg riseth néere the East southeast, and setteth West Sothwest, and shineth 8. houres, 54. minutes.

Pegasus shoulders riseth néere the East Northeast, and setteth néere the West Northwest, and shineth 14. hours 32. minutes.

Pegasus

Pegasus legge riseth néere Northeast, and setteth néere Northwest, and shineth 17. houres 6. minutes.

The Whales taile riseth East Southeast, and setteth West Southwest, and shineth 7. houres 48. minutes.

Furthermore, if you desire to know the time of anie of these Starres beeing aboue the Horizon in all Latitudes, then repaire to the eleuenth Chapter of maister Bournes Regiment for the Sea, so you shall know it there by their declination: euen by the same order that you knowe the Sunnes béeing aboue the Horizon, by the Sunnes declination.

A Table of the fixed Starres.

		These Starrres being South from the first day of Ianu. vnto the 15.			Ianu. from the 15. to the last.			Febru. from the 5. vnto the 15.			Febru. from the 15. to the last.		
1	Whales backe.	5. 20.	E	1	4.20	DA	1	3.20	DA	1	2.20	DA	
2	Whales belly.	5. 54	E	2	4.54	DA	2	3.54	DA	2	2.54	DA	
3	Rammes horne.	6. 28	E	3	5.28	E	3	4.28	DA	3	3.28	DA	
4	Rammes head.	6. 45	E	4	5.45	E	4	4.44	DA	4	3.45	DA	
5	Buls eie.	8. 52	E	5	7.52	E	5	6.52	E	5	5.52	DA	
6	Orions left foot.	9. 23	E	6	8.23	E	6	7.23	E	6	6.23	E	
7	Orions left shulder	9. 28	E	7	8.28	E	7	7.28	E	7	6.28	E	
8	First Orions girdle	9. 50	E	8	8.50	E	8	7.50	E	8	6.50	E	
9	Oriõs right shulder	10.12	E	9	9.12	E	9	8.12	E	9	7.12	E	
10	Great dogge.	11. 4	E	10	10.4	E	10	9.4	E	10	8.4	E	
11	Lesser dogge	12. 0		11	11.0	E	11	10.0	E	11	9.0	E	
12	Brightest in hydra	12.4	M	12	11.4	E	12	10.4	E	12	9.4	E	
13	Lions necke.	2.12	M	13	1.12	M	13	12.12	M	13	11.12	E	
14	Lions heart.	2.13	M	14	1.13	M	14	12.13	M	14	11.13	E	
15	Lions backe.	3. 0	M	15	2.0	M	15	1.0	M	15	12.0		
16	Lions taile.	3.42	M	16	2.42	M	16	1.42	M	16	1.42	M	
17	Rauens head.	5. 2	M	17	4.2	M	17	3.2	M	17	2.2.	M	
18	Rauens wing	5.19	M	18	4.19	M	18	3.19	M	18	2.19	M	
19	Virgins spike.	5.51	M	19	4.51	M	19	3.51	M	19	2.51	M	
20	Twixt boot thighs	5.56	M	20	4.56	M	20	3.56	M	20	2.56	M	
21	South Balance.	7.16	M	21	6.16	M	21	5.16	M	21	4.56	M	
22	North Balance.	7.33	MD	22	6.33	M	22	5.53	M	22	4.33	M	
23	Scorpions heart.	8.54	MD	23	7.54	MD	23	6.54	M	23	5.54	M	
24	Hercules head.	9.14	MD	24	8.14	MD	24	7.14	MD	24	6.14	M	
25	Serpents head.	9.41	MD	25	8.41	MD	25	7.41	MD	25	6.41	M	
26	The Eagle.	12.19	DA	26	11.19	MD	26	10.19	MD	26	9.19	MD	
27	Dolphins taile	1. 12	DA	27	12.12	DA	27	11.12	MD	27	10.12	MD	
28	Goates taile.	1. 48	DA	28	12.48	DA	28	11.48	MD	28	10.48	MD	
29	Water pourers leg	2. 48	DA	29	1.48	DA	29	12.48	DA	29	11.48	MD	
30	Pegasus shoulder	3. 47	DA	30	2.47	DA	30	1.47	DA	30	12.47	DA	
31	Pegasus leg.	4. 12	DA	31	3.12	DA	31	2.12	DA	31	1.12	DA	
32	Whales taile.	4. 24	DA	32	3.24	DA	32	2.24	DA	32	1.24	DA	

A Table of the fixed Starres.

March. frō the first to the 15.			March frō the 15. to the last.			Aprill. from the first to the 15.			Aprill from the 15. to the last			May from the first to the 15.		
1	1.20	DA	1	11.20	DA	1	11.20	MD	1	10.20	MD	1	9.20	MD
2	1.54	DA	2	12.54	DA	2	11.54	MD	2	10.54	MD	2	9.54	MD
3	2.28	DA	3	1. 28	DA	3	12.28	DA	3	11.28	MD	3	10.28	MD
4	2.45	DA	4	1. 45	DA	4	12.45	DA	4	11.45	MD	4	10.45	MD
5	4.52	DA	5	3. 52	DA	5	2. 52	DA	5	1.52	DA	5	12.52	DA
6	5.23	DA	6	4. 23	DA	6	3.23	DA	6	2.23	DA	6	1.23	DA
7	5.28	DA	7	4. 28	DA	7	3.28	DA	7	2.28	DA	7	1.28	DA
8	5.50	DA	8	4. 50	DA	8	3. 50	DA	8	2.50	DA	8	1.50	DA
9	6. 12	E	9	5. 12	DA	9	4.12	DA	9	3.12	DA	9	2.12	DA
10	7. 4	E	10	6. 4	DA	10	5. 4	DA	10	4. 4	DA	10	3. 4	DA
11	8. 0	E	11	7. 0	E	11	6. 0	DA	11	5. 0	DA	11	4. 0	DA
12	8. 4	E	12	7. 4	E	12	6. 4	DA	12	5. 4	DA	12	4. 4	DA
13	10.12	E	13	9. 12	E	13	8.12	E	13	7.12	DA	13	6.12	DA
14	10.13	E	14	9. 13	E	14	8,13	E	14	7.13	DA	14	6.13	DA
15	11. 0	E	15	10. 0	E	15	9 0	E	15	8. 0	E	15	7. 0	DA
16	11. 42	E	16	10.42	E	16	9 42	E	16	8.42	E	16	7.42	DA
17	1. 2	M	17	12. 2	M	17	11 2	E	17	10.2	E	17	9. 2	E
18	1. 19	M	18	12.19	M	18	11.19	E	18	10,19	E	18	9.19	E
19	1. 51	M	19	12.51	M	19	11.51	E	19	10.51	E	19	9.51	E
20	1. 56	M	20	12.56	M	20	11.56	E	20	10.56	E	20	9.56	E
21	3. 56	M	21	2.16	M	21	1.16	M	21	12.16	M	21	11.16	E
22	3. 33	M	22	2.33	M	22	1.33	M	22	12.33	M	22	11.33	E
23	4. 54	M	23	3.54	M	23	2 54	M	23	1.54	M	23	12.54	M
24	5. 14	M	24	4.14	M	24	3.14	M	24	2.14	M	24	1.14	M
25	5. 41	M	25	4.41	M	25	3.41	M	25	1.41	M	25	3.41	M
26	8.19	MD	26	7.19	MD	26	6.19	MD	26	5.19	MD	26	4.19	M
27	9.12	MD	27	8.12	MD	27	7.12	MD	27	6.12	MD	27	5.12	MD
28	9.48	MD	28	8 48	MD	28	7.48	MD	28	7.48	MD	28	5.48	MD
29	10.48	MD	29	9.48	MD	29	8.48	MD	29	7.48	MD	29	6.48	MD
30	11.47	MD	30	10.47	MD	30	9.47	MD	30	8.47	MD	30	7.47	MD
31	12.12	DA	31	11.12	MD	31	10.12	MD	31	9.12	MD	31	8.12	MD
32	12. 24	DA	32	11.24	MD	32	10.24	MD	32	9.24	MD	32	8.24	MD

A Table of the fixed Starres.

Maie. from the 15. to the last.			Iune from the first to the 15			Iune. from the 15. to the last.			Iulie from the first to the 15.			Iulie from the 15. to the last.		
1	8.20	MD	1	7.20	MD	1	6.20	MD	1	5 20	MD	1	4.20	M
2	8.54	MD	2	7 54	MD	2	5.54	MD	2	5 54	MD	2	4.54	MD
3	9.28	M	3	8.28	MD	3	7 28	MD	3	6.28	MD	3	5.28	MD
4	9.45	MD	4	8.45	MD	4	7 45	MD	4	6.45	MD	4	5.45	MD
5	11.52	MD	5	10.52	MD	5	9 52	MD	5	8.52	MD	5	7.52	MD
6	12.23	DA	5	11.23	MD	6	10.23	MD	6	9.23	MD	6	8 23	MD
7	12.28	DA	7	11 28	MD	7	10. 28	MD	7	9.28	MD	7	8.28	MD
8	12.50	DA	8	11.50	MD	8	10 50	MD	8	9 50	MD	8	8.50	MD
9	1. 12	DA	9	12.12	DA	9	11.12	MD	9	10.12	MD	9	9.12	MD
10	2.4	DA	10	1.4.	DA	10	12.4	DA	10	11.4	MD	10	10.4	MD
11	3 0	DA	11	2 0	DA	11	1.0	DA	11	12.0		11	11.0	MD
12	3.4	DA	12	2.4	DA	12	1 4	DA	12	12.4	DA	12	11.4	MD
13	5.12	DA	13	4 12	DA	13	3.12	DA	13	2.12	DA	13	1.12	DA
14	5.13	DA	14	4.13	DA	14	3.13	DA	14	2.13	DA	14	1.13	DA
15	6.0	DA	15	5.0	DA	15	4.0	DA	15	3.0	DA	15	2. 0	DA
16	6.42	DA	16	5.42	DA	16	4 42	DA	16	3 42	DA	16	2.42	DA
17	8.2	DA	17	7.2	DA	17	6.2	DA	17	5.2	DA	17	4. 2	DA
18	8.19	DA	18	7.19	DA	18	6.19	DA	18	5 19	DA	18	4.19	DA
19	8.51	DA	19	7.51	DA	19	6.51	DA	19	5.51	DA	19	4.51	DA
20	8.56	DA	20	7.56	DA	20	6.56	DA	20	5.56	DA	20	4.56	DA
21	10.16	E	21	9.16	DA	21	8.16	DA	21	7 16	DA	21	6.16	DA
22	10.33	E	22	9.33	DA	22	8.33	DA	22	7 33	DA	22	6.33	DA
23	11.52	E	23	10.54	E	23	9 54	DA	23	8.54	DA	23	7.54	DA
24	12.14	M	24	11.14	E	24	10.14	E	24	9.14	E	24	8.14	E
25	12.41	M	25	21 41	E	25	10.41	E	25	9 41	E	25	8.41	E
26	3.19	M	26	2.19	M	26	1.19.	E	26	12.19	M	26	11.19	E
27	4.12	MD	27	3.12	M	27	2.12	M	27	1.12	M	27	12.12	E
28	4.48	MD	28	3.48	M	28	2.48	M	28	2.48	M	28	12.48	M
29	5.48	MD	29	4.48	MD	29	3.48	M	29	2.48	M	29	1.48	M
30	6.47	MD	30	5 47	MD	30	4 7	MD	30	3.47	M	30	2.47	M
31	7.12	MD	31	6 12	MD	31	5.12	MD	31	4.12	MD	31	3.12	M
32	7.24	MD	32	6.24	MD	32	5 24	MD	32	2.24	MD	32	3.24	M

August from the first to the 15.			August from the 15. to the last.			Septem. from the first to the 15.			Septem. to the 15. to the last.			Octo to the first to the 15.		
1	3.20	M	1	2.20	M	1	1 20	M	1	12.20	M	1	11.20	E
2	3.54	M	2	2.54	M	2	1.54	M	2	12. 54	M	2	11.54	E
3	4.28	M	3	3.28	M	3	2.28	M	3	1. 28	M	3	12.28	M
4	3.45	MD	4	3.45	M	4	2.45	M	4	1. 45	M	4	12.45	M
5	6.52	MD	5	5.52	MD	5	4.52	M	5	3. 52	M	5	2. 52	M
6	7.23	MD	6	6.23	MD	6	5.23	M	6	4. 23	M	6	3. 23	M
7	7.28	MD	7	6.28	MD	7	5.28	M	7	4. 28	M	7	3. 28	M
8	7.50	MD	8	6.50	MD	8	5.50	MD	8	4. 50	M	8	3. 50	M
9	8.12	MD	9	7.12	MD	9	6.12	MD	9	5. 12	M	9	4. 12	M
10	9. 4	MD	10	8. 4	MD	10	7. 4	MD	10	6. 4	MD	10	5. 4	M
11	10.0	MD	11	9 0	MD	11	8. 0	MD	11	7. 0	MD	11	6. 0	M
12	10.4	MD	12	9. 4	MD	12	8. 4	MD	12	7. 4	MD	12	6. 4	M
13	12.12	DA	13	11.12	MD	13	10.12	MD	13	9.12	MD	13	8.12	MD
14	12.13	DA	14	11 13	MD	14	10.13	MD	14	9.13	MD	14	8.13	MD
15	1. 0	DA	15	12.0		15	11. 0	MD	15	10.0	MD	15	9. 0	MD
16	1.42	DA	16	12.42	DA	16	11.42	MD	16	10.42	MD	16	9.42	MD
17	3. 2	DA	17	2. 2	DA	17	1. 2	DA	17	12.2	DA	17	11.2	MD
18	3.19	DA	18	2.19	DA	18	1.19	DA	18	12.19	DA	18	11.19	MD
19	3.51	DA	19	2.51	DA	19	1.51	DA	19	12.51	DA	19	11.51	MD
20	3.56	DA	20	2.56	DA	20	1.56	DA	20	12.56	DA	20	11.56	MD
21	5.16	DA	21	4.16	DA	21	3.16	DA	21	2. 16	DA	21	1. 16	DA
22	5.33	DA	22	4. 33	DA	22	3. 33	DA	22	2. 33	DA	22	1. 33	DA
23	6.54	DA	23	5.54	DA	23	4. 54	DA	23	3. 54	DA	23	2. 54	DA
24	7.14	DA	24	6.14	DA	24	5.14	DA	24	4. 14	DA	24	3. 14	DA
25	7.41	DA	25	6.41	DA	25	5.41	DA	25	4.41	DA	25	3. 41	DA
26	10.19	E	26	9.19	E	26	8.19	E	26	7.19	E	26	6. 19	E
27	11.12	E	27	10.12	E	27	9.12	E	27	8.12	E	27	7. 12	E
28	11.48	E	28	10.48	E	28	9.48	E	28	8.48	E	28	7. 48	E
29	12.48	M	29	11.48	E	29	10.48	E	29	9. 48	E	29	8. 48	E
30	1.47	M	30	12.47	E	30	11.47	M	30	10 47	E	30	9. 47	E
31	2. 12	M	31	1.12	M	31	12.12	M	31	11.12	E	31	10.12	E
32	2.24	M	32	1.24	M	32	12.24	M	32	11 24	E	32	10.24	E

Octob. frō the 15. to the last.			Nouem. from the first to the 15.			Nouem frō the 15. to the last.			Decem. frō the first to the 15.			Decem. frō the 15. to the last		
1	10.20	E	1	9.20	E	1	8.20	E	1	7.20	E	1	6.20	E
2	14.54	E	2	9.54	E	2	8.54	E	2	7. 54	E	2	6.54	E
3	11.28	E	3	10.28	E	3	9.28	E	3	8. 28	E	3	7.28	E
4	11.45	E	4	10.45	E	4	9.45	E	4	8. 45	E	4	7.45	E
5	1.52	M	5	12.52	M	5	11.52	E	5	10.52	E	5	9 52	E
6	2.23	M	6	1.23	M	6	12.23	M	6	11.23	E	6	10.23	E
7	2.28	M	7	1.28	M	7	12.28	M	7	11.28	E	7	10.28	E
8	2.50	M	8	1.50	M	8	12.50	M	8	11.50	E	8	10.50	E
9	3.12	M	9	2.12	M	9	1.12	M	9	12.12	M	9	11. 12	E
10	4. 4	M	10	3. 4	M	10	2. 4	M	10	1. 4	M	10	12.4	M
11	5. 0	M	11	4. 0	M	11	3. 0	M	11	2. 0	M	11	1. 0	M
12	5. 4	M	12	4. 4	M	12	3. 4	M	12	2. 4	M	12	1. 4	M
13	7. 12	MD	13	6.12	M	13	5.12	M	13	4.12	M	13	2.12	M
14	7.13	MD	14	6.13	M	14	5.13	M	14	4.13	M	14	2.13	M
15	8. 0	MD	15	7. 0	M	15	6. 0	M	15	4. 0	M	15	4. 0	M
16	8.42	MD	16	7.42	MD	16	6.42	M	16	5.42	M	16	4.42	M
17	10.2	MD	17	9. 2	MD	17	8. 2	MD	17	7. 2	M	17	6.2	M
18	10.19	MD	18	9.19	MD	18	8.19	MD	18	7.19	M	18	6.19	M
19	10.51	MD	19	9.51	MD	19	8.51	MD	19	7.51	MD	19	6.51	M
20	10.56	MD	20	9.56	MD	20	8.56	MD	20	7.56	MD	20	6.56	M
21	12.16	DA	21	11.16	MD	21	10 16	MD	21	9. 16	MD	21	8.16	MD
22	12.33	DA	22	11.33	MD	22	10.33	MD	22	9. 33	MD	22	8.33	MD
23	1.54	DA	23	12.54	DA	23	11.54	MD	23	10.54	MD	23	9.54	MD
24	2.14	DA	24	1.14	DA	24	12.14	DA	24	11. 14	MD	24	10.14	MD
25	2.41	DA	25	1.41	DA	25	12.41	DA	25	11.41	MD	25	10.41	MD
26	5. 19	DA	26	4. 19	DA	26	3.19	DA	26	2.19	DA	26	10.19	DA
27	6.12	E	27	5.12	E	27	4.12	E	27	3.12	DA	27	2. 12	DA
28	6.48	E	28	5.48	E	28	4.48	E	28	3.48	DA	28	2. 48	DA
29	7.48	E	29	6.48	E	29	5.48	E	29	4. 48	E	29	3. 48	DA
30	8.47	E	30	7.47	E	30	6.47	E	30	5 47	E	30	4. 47	E
31	9. 12	E	31	8.12	E	31	7.12	E	31	6.12	E	31	5. 12	E
32	9.24	E	32	8.24	E	32	7.24	M	32	6.24	E	32	5. 24	E

NOW this Table serueth for euery moneth in the yeare (being exactlie calculated) their time of their being South, or touching your Meridian, (or as some tearme it) Monstead, seruing verie well the Seamen to take the height of them, with their Instruments vpon the Sea, referring it vnto the Table of declination that goeth before: The first is the houres, the second the minutes, the third be the letters that shew you whether they be south by day or by night, in the euening or morning, in the forenoone or afternoone, of the which the letter E. doth signifie euening, the letter M. signifieth morning, the letters DM. signifieth day in the morning, and the letter DA. signifieth day in the afternoone (as I said before) the verie houre and minute bæing South. Now you sée that I haue put to their being south in the day, aswell as in the night, to the intent to know the houre of the night, aswel by their setting, as also by your compasse, by bringing your 32. points into 24. houres: And in like maner (as M. Bourne hath shewed in the 4. chapter of his Regiment for the Sea) by shining of ỹ Moone to deuide the shining into equall parts, then those parts being equally deuided with the houre and minutes, and the time before their being South, put together ỹ halfe that shineth, & that sheweth the iust rising of the stars: & the other time of their shining after the height bæing South, sheweth their setting: Now you, sæing the table runneth frõ the first side of euery moneth to the 15. from the 15. to the last day, must consider (if you wil know the exact time betwæne the 1. daie and the 15 daie, and betwixt the 25. day, and the last) to doe this, looke how manie daies of the moneth is past, either from the first day or fiftænth day, and pull foure minutes from that number: for so manie daies as is past, for euerie day that shall shew you the true time of their being South, that known, you shall doe (as is aforesaid) for their rising and setting.

A Table of the true place of the Sunne.

Months	January.		February.		March.		April.		May.		June.	
Signs	Capricorne		Aquarius.		Pisces.		Aries.		Taurus.		Gemmini.	
Dayes	G	M	G	M	G	M	G	M	G	M	G	M
1	20	22	21	53	20	55	21	24	20	21	19	55
2	21	24	22	54	21	55	22	22	21	18	20	52
3	22	25	23	54	22	54	23	21	22	16	12	49
4	23	26	24	55	23	54	24	19	23	11	22	46
5	24	27	25	55	24	53	25	17	24	13	23	43
6	25	28	26	56	25	53	26	16	25	8	24	40
7	26	30	27	56	26	52	27	14	26	6	25	37
8	27	31	28	56	27	52	28	12	27	3	26	34
9	28	32	29	57	28	51	29	10	28	0	27	31
10	29	33	☉♓	57	29	50	☉♈	8	28	58	28	28
11	☉♒	35	1	57	☉♈	49	1	6	29	55	29	25
12	1	36	2	58	1	48	2	4	☉♉	52	☉♋	22
13	2	37	3	58	2	47	3	2	1	50	1	19
14	3	38	4	58	3	46	4	0	2	47	2	16
15	4	39	5	58	4	45	5	58	2	44	3	13
16	5	40	6	58	5	44	6	56	4	41	4	10
17	6	41	7	58	6	43	7	54	5	38	5	7
18	7	42	8	58	7	42	8	52	6	36	6	4
19	8	43	9	58	8	41	9	49	7	33	7	1
20	9	44	10	58	9	39	10	47	8	30	8	58
21	10	45	11	58	10	38	11	45	9	27	9	55
22	11	46	12	58	11	37	12	43	10	24	10	52
23	12	47	13	57	12	36	13	40	11	21	11	49
24	13	48	14	57	13	34	14	38	12	18	12	46
25	14	48	15	57	14	33	15	36	13	15	13	43
26	15	49	16	56	15	32	16	33	14	12	14	40
27	16	50	17	56	16	30	17	31	15	10	15	37
28	17	51	18	56	17	29	18	28	16	7	16	34
29	18	51	19	56	18	28	19	26	17	4	17	31
30	19	52			19	27		23	18	1		29
31	20	52			20	25			18	58		

A Table of the true place of the Sunne.

Months.	Iulie.		Auguſt.		Septēber.		Octōber.		Nouēber		Decēbe	
Signes	Cancer.		Leo.		Virgo.		Libra.		Scorpio.		Sagitta	
Dai.	G	M	G	M	G	M	G	M	G	M	G	M
1	18	26	18	2	18	4	17	39	18	49	19	24
2	19	23	19	0	19	2	18	39	19	50	20	26
3	20	20	19	58	20	1	19	38	20	51	21	27
4	21	17	20	55	21	0	20	38	21	52	22	29
5	22	14	21	53	21	58	21	38	22	53	23	30
6	23	11	22	51	22	57	22	38	23	54	24	31
7	4	8	23	48	23	56	23	38	24	55	25	33
8	25	5	24	46	24	55	24	38	25	56	26	34
9	26	2	25	44	25	54	25	39	26	57	27	36
10	27	0	26	42	26	53	26	39	27	58	28	37
11	27	57	27	40	27	52	27	39	28	59	29	39
12	28	54	28	38	28	51	28	39	☉♐	0	☉♑	40
13	29	51	29	36	29	50	29	39	1	1	1	42
14	☉♌	48	☉♍	34	☉♎	49	☉♏	39	2	3	2	43
15	1	46	1	32	1	48	1	40	3	4	3	45
16	2	43	2	30	2	47	2	40	4	5	4	46
17	3	40	3	28	3	46	3	40	5	6	5	48
18	4	38	4	26	4	45	4	41	6	8	6	49
19	5	35	5	24	5	44	5	41	7	9	7	51
20	6	32	6	22	6	44	6	42	8	10	8	52
21	7	30	7	21	7	43	7	42	9	11	9	54
22	8	27	8	19	8	42	8	43	10	12	10	55
23	9	25	9	17	9	42	9	43	11	13	11	57
24	10	22	10	16	10	41	10	44	12	14	12	58
25	11	20	11	14	11	41	11	45	13	15	13	59
26	12	17	12	13	21	41	12	45	14	16	15	1
27	13	15	13	11	13	40	13	46	15	18	16	2
28	14	12	14	10	14	40	14	47	16	19	17	3
29	15	10	15	8	15	39	15	47	17	20	18	5
30	16	7	16	7	16		16	48	18	22	19	6
31	17	5	17	5			17	49		23	20	7

The Table of the Equation of the Sun.

The yeres of our Lord.	The equatiõ to be added.		the yeres of &c.	the equation, &c		the yeres of, &c.	the equation, &c.		the yeres of, &c	the equatiõ, &c.	
	G	M		G	M		G	M		G	M.
1545	Kl.	0	1581	I	16	1617	I	32	1653	I	48
1546		45	1582	I	1	1618	I	17	1654	I	33
1547		30	1583		46	1619	I	2	1655	I	18
1548		15	1584		32	1620		47	1656	I	3
1549	I	2	1585	I	18	1621	I	33	1657	I	49
1550		47	1586	I	3	1622	I	18	1658	I	34
1551		32	1587		48	1623	I	3	1659	I	19
1552		18	1588		33	1624		49	1660	I	4
1553	I	4	1589	I	19	1625	I	35	1661	I	51
1554		49	1590	I	4	1626	I	20	1662	I	36
1555		34	1591		49	1627	I	25	1663	I	21
1556		19	1592		35	1628		51	1664	I	7
1557	I	5	1593	I	21	1629	I	37	1665	I	53
1558		50	1594	I	6	1630	I	22	1666	I	38
1559		35	1595		51	1631	I	7	1667	I	23
1560		21	1596		37	1632		53	1668	I	9
1561	I	7	1597	I	23	1633	I	38	1669	I	55
1562		52	1598	I	8	1634	I	23	1670	I	40
1563		37	1599		53	1635	I	8	1671	I	25
1564		23	1600		39	1636		54	1672	I	10
1565	I	9	1601	I	25	1637	I	40	1673	I	56
1566		54	1602	I	10	1638	I	5	1674	I	41
1567		39	1603		55	1639	I	10	1675	I	26
1568		25	1604		40	1640		56	1676	I	12
1569	I	11	1605	I	26	1641	I	42	1677	I	58
1570		56	1606	I	11	1642	I	27	1578	I	33
1571		41	1607		55	1643	I	12	1679	I	28
1572		26	1608		32	1644		8	1680	I	13
1573	I	12	1609		28	1645	I	44	1681	R2	0
1574		57	1610	I	13	1646	I	29	1682	I	45
1575		42	1611	I	58	1647	I	14	1683	I	30
1576		28	1612		44	1648	I	0	1684	I	15
1577	I	14	1613	I	30	1649	I	46	1685	I	2
1578		99	1614	I	15	1650	I	31	1686	I	4
1579		44	1615	I	10	1651	I	16	1687	I	32
1580		29	1616		46	1652	I	2	1688	I	8

This Table of the Equation of the Sunne, serueth from the yeare of 1545. where it hath his rote or beginning, vntill 1680. and in the yeare of 1681. it shall returne to the rote, adding thereunto one degrée more. As for example: In the yeere of 1681. adde one degrée vppon the other degrée that the rote hath, and so shall the yeare of 1681. haue two degrées of Equation, and the yeare of 1682. shall haue one degrée and 45. Minutes, which is to adde one degrée vpon 45. minutes, that had the year 1546. &c. And hauing passed ouer 136. yeares, you shall returne to the rot, adding 2. degrées.

Signes	♈	♉	♊	♋	♌	♍	Signes
G	G M	G M	G M	G M	G M	G M	G
0	0	24	11 30	20	12	25	30
1	0	48	11 51	20	25	29	
2	0	12	12 12	20	37	28	
3	1	46	12 33	20	49	27	
4	1 2	0	12 53	21	0 11	26	
5	2	23	13 13	21	22	25	
6	2	47	13 33	21	32	24	
7	3	11	13 53	21	42	23	
8	3	35	14 13	21	51	22	
9	3	58	14 32	21	0	21	
10	4	22	14 51	22	9	20	
11	4	45	15 10	22	17	19	
12	5	9	15 28	22	25	18	
13	5	32	15 47	22	32	17	
14	5	55	16 5	22	39	16	
15	6	19	16 23	22	46	15	
16	6	42	16 40	22	52	14	
17	7	5	16 57	22	57	13	
18	7	28	17 14	23	3	12	
19	7	50	17 31	23	8	11	
20	8	13	17 47	23	12	10	
21	8	35	18 3	23	15	9	
22	8	58	18 19	23	19	8	
23	9	20	18 34	23	22	7	
24	9	42	18 49	23	24	6	
25	10	4	19 4	23	26	5	
26	10	26	19 18	23	28	4	
27	10	47	19 32	23	29	3	
28	11	9	19 46	23	30	2	
29	11	30	19 59	23	30	1	
30			20 12			0	
Signes.	♐	♑	♒	♓	♃	♋	Signes.

The Chapter of the Declination of the Sunne.

THe Declination of the Sunne, is the arke of the greater circle, which passeth by the Poles of the worlde, included betweén the Equinoctial and the Zodiack. And héere is to be noted, that whatsoeuer foure points or pyckes which are equallie distant from the points of the Equinoxis (which are the beginning of Aries and Libra) shall haue equall Declinations.

Whereof it followeth, that the foure quarters of the Zodiacke haue equall declinations. And to auoyde prolixity, I haue added héere vnto a Table of the declinations of onely one quarter of the Zodiacke, so that all hauing one selfe same manner of Declinations, it may serue for all. and the order of it is this. The signes whose Declination increaseth, are in the head or front of the Table, and the degrées of these signes descend by the left side thereof, & the signes whose declination decreaseth, are in the foote of the Table: and the degrées of these signes, rise by the right side of the same. The disposition of the Table béeing vnderstood, then to knowe what declination the Sunne hath in euerie degrée of the Zodiacke, you ought to knowe the true place of the Sunne, for the daie of the declination which you desire to knowe, and the signe which the Sun shall bee found in that daie, shall you séeke in the front or foote of the Table. And if it bee in the front, you shall séeke the number of the degrées on the left side, and if it shall bée at the foote of the Table, you shall séeke it on the right side. Then aboue or vnder the signe, in the front of that degrée of the said signe, you shall find two numbers, whereof the first is of degrées, and the second of minutes: and those degrées and minutes of Declination, the Sunne hath that daie. And this is vnderstood without hauing respect to the

odde

od minutes aboue the degrée, which the true place of the Sunne hath.

And if you desire to verifie this more precisely, note the Declination of that degrée, and of the degrée following: and take the lesse from the more, and that which remaineth, shall be the difference of the declination from the one degrée to the other: of which difference ye shall take a part proportionallie, as are the minutes of the place of the Sun vnto 60. And this part of minutes must bee added to the first declination of it, and be lesse then the second, or must be taken from it, if it shall be greater, and then that riseth thereof shall be the precise declination for that signe, degrée, and minute. As for example: In the yeare 1546. the tenth daie of September, the Sunne shall be in 26. G. 38. M. of Virgo, and the 26. G. precise, shal correspond 1. G. 36 M. of declination. And to verefie the declination that commeth to 38. minutes, which is more of the 26. G. you must marke the difference that is from the declination of 26. G. (which is one G. 36. M.) to the declination of the 27. G. which is one G. 12. M. The difference is 24. M. Of these you must take such part proportionally, as the 38. minuts beareth vnto 60, which are almost two terces of a degrée: Then the two terces of 24. are 16. which must bee taken from one degrée 36 minutes, which correspond to the 26. G. of Virgo, because the declinations goe decreasing, and remaineth 1. G. 20. M. and if the declinations increase, you must adde thereunto, as you take awaie when they decrease.

Another example for this yeere of 1561.

Example for the yéere 1561. the 20. of Aprill, I find the true place of the Sunne at noone, in 9. degrées 54. minutes of Taurus: then in the table of the signes before, I séeke for 9. degrées of Taurus, to which doth aunswere for the declination 14. degrées 32. minutes, and to the nert degrée following doth answere 14. degrées 51. minutes, then take

the leſſer out of the more, ſo reſteth 19. minutes. Then forme a rule of thrée, and ſaie: if 60. minutes giue 54. minutes, (which 54. minutes doeth reſt before of the 9. degrées of Taurus) how many doth 19. minutes giue, which 19. minutes are the diuerſitie of the 9. and 10. degrées of Taurus. So I find that 14. minutes giueth 17. minutes, and 6. ſeconds, which 17. minutes and 6. ſeconds, I adde to the 14. degrées 23. minutes, which anſwereth to the 9. degrées of Taurus. And it commeth to 14. degrées 49. minutes, and 6. ſeconds, which is the true declination of the 20. daie of Aprill. Anno. 1561.

It is alſo to be noted, that I adde theſe 17. minutes and 6. ſeconds, becauſe the declination doth increaſe: for if it decreaſed, it were to be taken out ſo much, and the reſt is the declination. So is the declination for the twentie of Aprill, in the yeare 1561. fourteene degrées, 49. minutes, and fiue ſeconds.

FINIS.

AT LONDON

Printed by Edward Alde, and are to be ſold by Heugh Aſtley, dwelling at Saint Magnus corner.

Anno. 1592.

A

DISCOVRSE OF *THE VARIATION* of the Compaſſe, or *Magneticall* Needle.

Wherin is Mathematically shewed, the manner of the obſeruation effects, and application therof, made by W.B.

And is to be annexed to the new attractiue of *R. N.*

Imprinted at London by E. Allde, for Heugh Aſtley. dwelling at S. Magnus Corner. 1562.

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¶ To the trauailers, Sea-men, and Mariners of England.

HAuingof late gentle(Reader)receaued from the expert Artificer, Robert Norman, his Booke,entituled: The new Attractiue(who of the great good will,and affection he beareth, hathattributed in his Dedication, that which I acknowledge not to be due) in the which amongeſt other dyuers vertues and properties of the Magnes or Loadſtone,he entreateth of the declyning of the Needle touched therewith,from the plaine of the Horizon, (a matter neuer before found or written of by any.) For the further behoue and benefite of all trauaillers and Sea-men, I tooke occaſion to enlarge the ſame with this diſcourſe of the Variation of the Compaſſe, wherein I haue handled the whole varietie of that ſubiect, both Practically, and Mathimatically, to the end I might partly ſatisfie both the vulgare, and alſo the learned ſort. For, knowing the variation of the Compaſſe to be the cauſe of manye errours and imperfections in Nauigation, and perceiuing that all thoſe that haue as yet gone about to giue rules in that arte,haue left this (being a principall point, and euen the grounde ofall the reſt) vntouched,or at leaſt ſo ſleightly handled the ſame, that little or no benefite could be gathered thereby: I haue heere ſet downe the ſundrie waies to obſerue the ſame at all times and places,that the inconuenience being knowne,might be conſidered off,and auoyded. Wherein, although my chiefeſt intent hath beene to pleaſure thoſe that ſhall haue occaſion to put the thing in practiſe by their owne trauaile and experience,yet becauſe ſome of the rules are deducted from the

fountaines of the Mathematical Sciences, and wrought by the doctrnie of Signes and Tryangles, which maye ſeeme ſtraunge in our Engliſh tongue, and wherwith few Sea-men are yet acquainted, I maye ſeeme to haue miſſed of my firſt good meaning, but I wold wiſh them to chooſe that which is plaine and conformable to their capacities, and make their profit thereof, and for the reſt vnderſtand, that of ſuch obſeruations as they themſelues cannot preſently apply to the purpoſe, by others, that are throughly inſtructed in theſe Mathematicall ſupputations, or by themſelues when they ſhall attaine to the knowledge thereof, may be inferred ſuch effectual matter, as is by theſe rules and precepts promiſed. Wherefore I would haue al Sea-men to vſe ſuch diligence in their trauails, that no opportunity be omitted, whē, or wher any obſeruation may be made, either for the variation, or latitude of places, or anye other neceſſarye poinct incident to Nauigation, & thereof to keepe continual notes & memoriall. For theſe obſeruations there needeth not many troubleſome inſtrumentes, onely for the variation, the new inſtrument in the end of this Treatiſe I preferre before all other. And for eleuations, a plaine Aſtrolobe exactlye made, and a croſſe ſtaffe are ſufficient. (The Globe wer alſo a very good & neceſſarie inſtrument: for beſides many pleaſant concluſions that may be tryed by it, it dooth lighten very much the conceits: for vnderſtanding diuerſe importāt poincts, but it is too troubleſome (or otherwiſe not fit for euery Marriner) to be caried to the ſea. Vnto the which may be added the Topographicall inſtrumēt, for taking of diſtāces, & making deſcriptions vpon the land. With theſe inſtruments, and the ſailing Compas and Marine Plat, (which are alwaies to be vnderſtoode the principall, and moſt neceſſary inſtruments for Nauigation, for by them only, any voyage may be made, but without them no nauigation can bee performed,) the whole worlde may be trauailed, diſcouered, and diſcribed. Theſe are ſufficient for a perfect Mariner, and more then theſe were ſuperfluous, only the running glaſſes, leads, lines,

and

and ſuch like appendances, of other excepted.

But to haue all theſe inſtruments, and not to vnderſtand the grounds how to vſe them, were a great vanity. Therfore I wiſhe al Sea-men & trauailers, that deſire to be cunning in their profeſsion, firſt to ſeek knowledge in Arithmetike, & Geomatrye, which are the groundes of all ſciences and certaine arts, of the which there is written in our Engliſh tong, ſufficient for an induſtrious and willing minde to attaine to great perfection, wherebye hee may nor onelye iudge of Inſtruments, Rules, and precepts giuen by other, but alſo be able to correct them, and to deuiſe new of himſelfe. And this not onely in Nauigation, but in all Mechanicall Sciences. As by the ſtudious practiſe and exerciſe in theſe Arts, haue attained to rare and ſingular knowledge: In Architecture, Vitriuuius the Romaine, in painting that famous Germaine Albertus Durerus: And in building of ſhips, Mathew Baker our Countri-man: and others in other faculties as they haue bene moſt skilfull heerein, ſo haue they excelled. Hauing theſe helps and groundes, with the Inſtruments before ſpecified, a Mariner may be able to make deſcription in plat, of the coaſts and countries, and of the banks, rocks, & ſholds in the Sea, with the depths, and other neceſſarie notes obſerued in his owne trauials, perticulerlie and effectuallie according vnto the truth, (which is the chiefeſt part required in a perfect Mariner.) And not be allwaies tied to the reports of other, or to the Portugale, or Spaniſh Marine Plats, which are made dy the Card makers of thoſe Cuntries, men that are no trauailers themſelues, but doe all things therein, by information, and vpon the credite of others, which onelie commit to memorie the forme & manner of the Sea coaſts, with making ſome few notes of the lying of one place from another, which can neuer bee ſo perfect as the deſcriptions that are made vpon the preſent ſight and view of places, albeit he be neuer ſo ſkilfull and cunning, that ſhall ſo carrie the ſame by memorie, how much leſſe thē by the vnſkilful. By this meāes the card makers ſet down they know not what

as maye appeare by the deſcriptions of their owne coaſtes, which are verie groſly and vnperfectly done, whereas the Marine Plats ought to be deſcribed by ſuch as can giue reaſon, and ſhew obſeruation, of euery perticularitie contained in the ſame, as well for the latitude of places, as the lying by the compaſſe of the Capes, Head-landes, Poinctes, Ilandes, Baies, Rockes, Sholdes, &c. one from another, and the diſtances betweene them. The errours of thoſe diſcriptions, I may not attribute to the Cardmakers, but to the vnskilfull Seamen of thoſe countries, for if they were otherwiſe, as they haue beene accounted the moſt ſkilfull of the worlde, thoſe errors could not haue continued as they do: true it is, that for their great trauailes, they haue bene worthely famous aboue all other nations, till now at length our Countrie-man Sir Frances Drake, for valarous attempt, prudent procedinges, and fortunate performing his voyage about the world, is not onely become equall to anie of them that liue, but in fame farre ſurmounteth them all. But thoſe Card-makers, and all other that collecte and gather Hydrographicall, and Geographicall deſcriptiones of other mens trauailes or reports: as their paines may be great, and deſerue due commendations, ſo their doings may bring commoditie diuerſely. And in this behalfe Abrahamus Ortelius in his Theatrum, hath deſerued immortall praiſe, for collecting together, and reducing into one commodious volume, the diuerſe Plats and deſcriptions, made by diuerſe and ſundrie men. But amongſt all thoſe that haue made Geographical deſcriptions, I cannot a little meruell at Gulielmus Poſtellus, who beeing a famous learned man, a great trauailer and Coſmographer, & Deane of the Kings profeſſors in the Vniuerſitie of Paris, in his vniuerſall Map. An. 1580. beſides that, it is generallie handled after ſuch a groſe and confuſed manner, that it might ſeeme rather to haue come from ſome rude vnſkilfull, then from him ſo famous a Doctor, hathe alſo in the imagined Countries about the North Pole, ſo corrupted it with his fond dreames, & fantaſtical inſcriptions, attributing to thoſe

ſuppo-

ſuppoſed lands, diuerſe people, as the Georgians and Hyperborians, and aſsigning there to be the higheſt hilles of the world, and the people dwelling on them, to haue the continual light of the Sunne, Sueta Zemlia found by the Engliſhmen, An. 1550. the holie Land, the place of the chiefeſt felicitie, the Hyperborean fields, & therfore the felicity of the Moluccas, with many other ridiculous abſurdities: That by the groſe errours of this learned man in theſe matters, I am taught, that whatſoeuer fame goeth, or opinion is conceiued of anie man for profound learning, and ſmooth deliuering of their conceits, or whatſoeuer great promiſes are by themſelues made in theſe artes, to iudge of thē according to the works that come from thē, & not otherwiſe to be deceiued.

For auoiding prolixitie in this my Preface to ſo ſmall a volume, I referre thee gentle Reader, to the worke it ſelfe. Yet by the waie it ſhall not be amiſſe, that I commend vnto you the Table of the Sunnes declinatiō (or Regiment) made by R.N. which is calculated for the preſent time, and differeth not from the truth in anie place aboue one minute, wheras in all other hetherto made and extant, there are great errors. Therefore, ſuch as otherwiſe cannot from time to time calculate their declinatiōs, according to the place of the Sunne to be giuen by the Ephemerides, and table of Declination of Reinholdus, may boldly vſe this Regiment for 20 yeares, without anie ſenſible error. And ſo wiſhing my trauailes in this treatiſe, may doo ſuch good as I meant, I commit the ſame to your gentle conſtructions, & your ſelues to the Almightie. At Limehouſe the 26. of September.

Anno. 1581.

William Borough.

¶ A Table of the chapters contained in the Treatiſe.

The firſt Chapter.

OF the Variation of the Compaſſe or Magneticall Needle.

The ſecond chap.

The manner how to vſe the Inſtrument of Variation.

The third chap.

How to finde the Variation of the Compas or Needle at anye place, the eleuation of the Pole, and the ſcituation of the Meridian vnknowen.

The fourth chap.

The eleuation of the Pole, and place of the Sunne giuen, how vpon the Globe, to finde the Variation of the Needle by anye one obſeruation, either in the forenoone or afternoone.

The ſift chap.

How to finde the Variation, by Arithmeticall calculation, vpon any one obſeruation, in forenoone or afternoone, the latitude of the place, and declination of the Sunne beeing giuen.

The ſixt chap.

Another way moſt generall, how to finde the Variation by one obſeruation, either in forenoone or afternoone, the eleuation of the Pole, and Declination of the Sunne, being giuen.

The

Of the Compas.

The Table.

The ſeuenth chapter.

To finde the eleuation of the Pole, ſcituation of the Meridian, and variation of the Needle, at any place by the Sunne, vpon two obſeruations, either in forenoone or afternoone.

The eight chap.

Of the Pole of the Magnes

The ninth chap.

Of the poinct Reſpectiue.

The tenth chap.

Of the application of the Variation, to the vſe of Nauigation.

The eleauenth chap.

Of the inconueniences and defects in ſailing, and in deſcription of countries, cauſed by the variation of the Compas.

The twelfth chap.

Of the inſtruments and rules of Nauigation.

¶ Of the Variation of the Compasse or magneticall Needle.

Chapter I.

THE Variation of the Needle or Compas, is properly the Arke of the Horizon, contained betweene the true Meridian of anye place, & the magneticall Meridian of the same, and is denominated to bee Easterly, or Westerly, according to the position of the magneticall Meridian to the Eastwards or Westwards of the true Meridian: And may be accompted either from the north part, or the South part thereof, but vpon opposite poincts it hath contrary denominations.

The Magnetical Meridian, is to be vnderstood a great circle passing by the Zenith, and the Pole of the Magnes diuiding the Horizon into two equall partes crossing the same at opposite poincts: which intersections or crossings, are shewed by the Needle, or wiers of the Compas, touched with the Magnes or the Loadstone.

The Azimuth of the Sunne is a great circle, passing by the Zenith, and the true place of the Sunne: crossing the Horizon at right angles in opposite poincts, and diuiding the same into two equall partes, and it is said to be giuen when the distaunce thereof from the true Meridiã is knowne.

The Azimuth of the Sunne vppon equall eleuations in forenoone or afternoone, haue equall distaunces from the true Meridian, so that the middle poinct of the whole difference of any two Azimuths obserued vpon equall eleuations in forenoone or afternoone, is the true Meridian.

This difference of Azimuths, is found vpon the Instru-

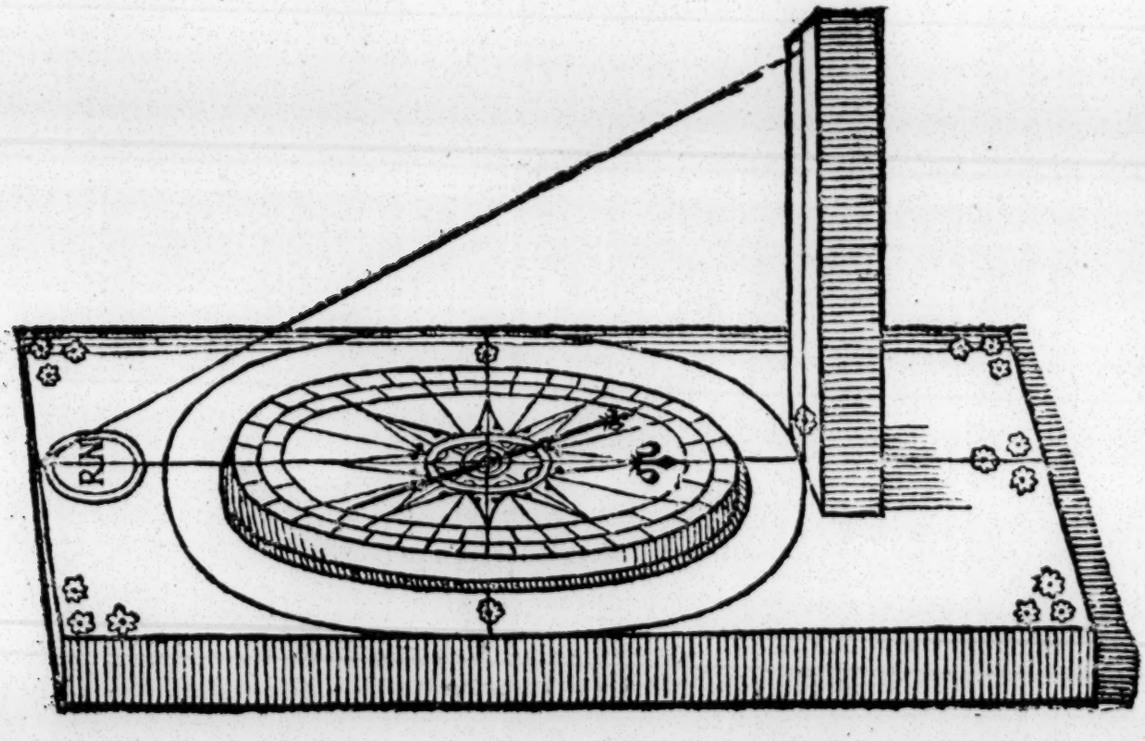
ment

ment of Variation, by adding together the Variations of the Sunnes shadow, at equal eleuations in forenoone and afternoone. The halfe whereof is the distaunce of the Azimuths from the true Meridian: the which compared with either of the same Variations of the Sunnes shadowe, the difference shal be the Variation of the Needle, from the true Meridian.

Or els subtracting the lesser variation of the Sunnes shadow, from the greater (at equall eleuations) the halfe of the remainer shall be the true Variation of the Needle from the Meridian.

But the Azimuth of the Sunne being otherwise giuen, and the Variation of the shadow likewise giuen, the difference betweene them, is the variation of the Needle.

The Variation of the Sunnes shadowe, I call the Horizontall distaunce betweene the Azimuth of the Sunne, and the magneticall circle, which are represented in the Instrument, by the shadow of the line, and the Needle.



Of the Variation.
The second Chapter.

The manner how to vse the instrument of Variation.

FIrst you must place the Instrument vpon some stoole, or other thing that is flat, so as it may stand leuell, & the Plummet in the Standard which is placed at the North end of the fixed Flie, may fall perpendicularly, with the line in the same Standard.

You must haue regard that in remouing the instrument to the Sunne as hee goeth about, it maye alwayes stand leuell as aforesaid.

You are then to consider, that the string that reacheth from the South parte of the instrument, to the top of the standard, is the chiefest string to giue the Suns shadowe which must bee so directed by turning the Instrumentes South side to the Sunne wards, that the shadowe of the same may fall directly longst vppon the line of South and North in the fixed Flie, for it ought not to crosse or decline from the same line in any part, but if it do, you must seeke to reforme it, by setting the Standard more vpright, or remouing it at the South end.

Then must you also see, that the string that is fastned to the hoope of Brasse that enuironeth the fixed Fly, may be so placed, that it agree Iustly with the shadow of the former line, and the line of South and North in the fixed Flie, in such sort that both the shadows may be as it were hidden in the said line of the Flie: which you may do aptly by turning the said hoope, and remouing the same lyne at either side of it, as you shall see cause.

The Instrument beeing duly placed in forme aforesaid, it differs nothing from the Compas of Variation, but onely in this point, that where as the Flie of the compas of Variation, is so turned by vertue of the Magneticall

wiers,

wiers, that the North point thereof doth shewe the Pole of the Magnes, or line of Variation. In this Instrument, the North point of the Needle dooth suppplie that, which the North point of the compas should do. And the North point of the Flie which is fixed in the bottome of the Instrument, doeth alwaies aunswere to the shadowe that the Sunne giueth.

The third chapter.

How to finde the variation of the Needle or Compas at any place, the eleuation of the Pole, and scituation of the Meridian vnknowne.

When you would obserue the variation in any place, you must begin in the forenoone the soner the better, and the more effectuall may your obseruations bee, doe thus.

Take your Astrolobe, and obserue duly the height of the Sunne, for your more ease it shall be best for you to note the same, when it agreeth to be iust vpon a degree, without any consideration of minuts, or fractions, and at the instant of the same hieght, turne your instrument to the Sunne, so as the shadowe of the lines, may fall iustly vpō the line of South & North in the fixed Flie.

Then, when the Needle doth stand, loke directly ouer the North point of the Needle, what degree and fraction, if there be any doth answer vnto the same in the fixed flie, that is to say, how many degrees it is from the North of the fixed Flie, which you shall note diligently, and maye say, that so many degrees, &c. is the variation of the Suns shadow from the North, as the North point of the Flie is from the North point of the Needle, either Eastwards or Westwards as you shall finde the same. Thus may you obserue diuerse times, vpon seuerall degrees of the Suns

eleuation. And like as you do in the forenoone, so must you alſo obſerue the Sunnes eleuation in the afternoone, vpon the ſame degrée of height, and with the ſame ſide of the Aſtrolobe and Inder turned towards the Sunne, as it was in the forenoone (for auoiding of errour that may be in the Inſtrument) noting at euerie height, what you find the variation. And when the Sunne commeth to the Meridian, it ſhall be good that you exactlye obſerue his eleuatiõ vpon the ſame, for knowing the true latitude of the place: all which you ſhall ſet downe in forme following.

Example.
In Limehouſe the ſixtenth of October. Anno. 1580.

Forenoone			Afternoone.			
Eleuation of the Sunne.	Variation of the ſhadowe frõ the North of the Needle to the Weſtwards.		Eleuation of the Sunne.	Variation of the ſhadowe frõ the North of the Needle to the Eaſtwards.		Variation of the Needle from the Pole or Axes.
Deg.	Deg.	Min.	Deg.	D.	M.	D. M.
17	52	35	17	30	0	11 17 1/2
18	50	8	18	27	45	11 11 1/2
19	47	30	19	24	30	11 30
20	45	0	20	22	15	11 22 1/2
21	42	15	21	19	30	11 22 1/2
22	38	0	22	15	30	11 15
23	34	40	23	12	0	11 20
24	29	35	24	7	0	11 17
25	22	20	25	Frõ N. tow. O. 8.		11 14

The

The eleuation of the Sunne vpon the Meridian 25.d. 58′. the declination 12.d. 30′. which I adde to the eleuation, because the Sunne hath south declination, and therof amounteth 38.d. 28′. the eleuation of the equinoctiall, the which I substract from 90.d. the rest is 51. d. 32′. the eleuation of the Pole Artike.

Now are you to consider, that out of the great Variation of a shadow vpon anye degrée of the Sunnes eleuation, is to be taken the lesser of the same degrées eleuatiō, whether it be in the forenoone or afternoone (except the same variations bée both one waye from the North of the Néedle, which then are to be added) the halfe of the remainer, is the variation of the Néedle, or Compas, from the Pole or true Meridian.

In the former obseruations, I do find the greatest variation in the forenoone, for at 17.d. eleuation, the variatiō is 52.d. 35′ from North to West: And at the same eleuation in the afternoone, I finde the variation to bee but 30.d. 0′. from North to East. I take the lesser out of the greater, and finde remaining 22.d. 35′. the halfe thereof is 11.d. 17′ ½. So much I say is the Pole Artick, and true Meridiá line that passeth to the Pole, by our Zenith at London, to the Westwards of the north that the Néedle sheweth. And therefore the Néedle or Compas varieth from the true north, 11.d. 17′ ½. to the eastwardes.

Also at 25.d. eleuation in the forenoone, the variation is 22.d. 20′. from North to West: at the same eleuation in the afternoone, the variation is 0.d. 8′. from North to West. Now because the variations are both one waye, (that is to the Westwards) I adde them together (and so ought you to doe, as often as you find the variations so to agrée) & I finde that they amount to 22. d. 28′. the halfe thereof is 11.d. 14′. which is the variation.

The variations of the Néedle or Compas by the former obseruations, are set out towardes the right hand against euery degrées eleuation, and conferring them al together,

I doe finde the true variation of the Néedle or Compas at Limhouſe to be about 11.d.¼ or 11.d.⅓. which is a poinct of the Compas iuſt or little more. So that in a Compas whoſe wiers are ſet directly vnder the flowre de Luce, the North and by Weſt, and South and by Eaſt poinctes doe ſhew the true Meridian.

The eleuation of the Pole, and place of the Sunne giuen, how vpon the Globe, to find the variation of the Needle by any one obſeruatioin, either in forenoone or afternoone.

The fourth Chapter.

IN the former declaration, the onely waye to trye the variation, is by comparing of the ſeuerall correſpondent obſeruations of the Sonnes eleuation in the forenoone, with thoſe of the afternoone, ſo that if the Sunne ſhould be obſcured, or by anye other occaſion like obſeruatiõ cannot be made in the afternoone, then the former rule giueth not the deſired purpoſe. Therfore I thought good to ſhew, how by any one obſeruation in the fore or afternoone, the eleuation of the Pole & place of the Sunne giuen, you may knowe the true Meridian and the variation of the néedle from the ſame in any place which thing may be done and aptly demonſtated vpon the Globe, but moſt exactly calculated by the Table of ſignes.

To find out the variariation vpon the Globe, you muſt firſt ſet your Globe to ſtand duely according to the eleuation of the Pole at the place propoſed. Then ſeeke in the Ephemerides, for the true place of the Sunne that day, & note it with ſome ſmall prick in the Eclipticke of the globe And placing the Quadrant of altitude or moueable verticall, at the verticall poinct or Zenith, take the eleuation

of

of the Sunne obſerued by the Aſtrolobe or other Inſtrument at the time propoſed, and note it iuſtlie vppon the ſame quadrant of altitude. Then turne your Globe and Quadrant towards that part of the Horizon that the ſun was in at the time of the obſeruation, till the pricke you made for the place of the Sunne in the ecliptike, concurre and agrée iuſtlie with the eleuation marked in the ſayde quadrant of altitude. So ſhall you ſée the quadrant ſhewe you vpon the Horizon, the Azimuth and diſtance of the Sunne from the true Meridian of that place, which you ſhall compare with the variation obſerued vppon the Inſtrument at that inſtant of the Sunnes eleuation. And if they agrée and concurre iuſt, then ſhal you be in the true and common Meridian, which ſheweth the Pole of the world, and Pole of the Magnes or Loadſtone. But if they differ, you ſhal ſubſtract the leſſer from the greater, the remainer ſheweth the Variation. And if the variation vpon the Inſtrument be greater then the true diſtance of the Azimuth from the Meridian found vpon the globe, the ſame ſurplus is to be accounted for variation: vpon the contrarie ſide of the Meridian: if it be leſſe, it is to be accounted on the ſame ſide of the Meridian that the variation is taken, whether it bee in the forenoone or afternoone. This precept néedeth no further demonſtration, then the inſtrument it ſelfe, the Globe I meane.

But for example of the worke, I take the firſt obſeruation, in the former Chapter ſpecified, made at Limehouſe, the ſixteenth of October. 1580. in the forenoone, which is 17.d. eleuation, & variation 52.d.35′. from North to Weſt.

Firſt I ſet my Globe at 51.d.32′. for the eleuation of the Pole. Secondly, I take the place of the Sunne 2.d.55′.m. and note it vpon the Ecliptick. Thirdly, I note vpon the Quadrant of altitude, the eleuation of the Sunne. 17.d. This done, I moue the quadrant of altitude towards the Eaſt of the Horiſon, and turne the Globe till the pricke in

the Eclipticke for the place of the Sunne, do agrée iustly, with the eleuation noted vpon the quadrant of altitude, & find the true Azimuth shewed by the same quadrant vpon the Horizon to be néerest, about 41. ½. from the Meridian. And conferring the same with the variation found vppon the Instrument 52.d.35′. I finde the difference 11.d.15′ And because the obseruation is noted to be in the forenoone from the North to the West, or South to the East, and the variation vpon the Instrument greater then the Azimuth found on the Globe, I account the same from the North to the East, or from the South to the West. So I conclude the variation at Limhouse to be about 11. ¼ from North to East, or South to West.

How to finde the variation by Arithmeticall calculation vpon anie one obseruation in the forenoone or afternoone, the latitude of the place, and declination of the Sunne being giuen.

The fift Chapter.

THe summe of the worke is to finde the arke of the Horizon betweene the Meridian and the Azimuth of the Sun at the time of the obseruation, which being cõpared with the variation found in the instrument, the difference is the variation of the Needle. For attaining of the same Arke. First it is necessarie to haue the Arke of the Equinoctiall betweene the Sunne at the time of the obseruation, and the Meridian, which arke is thus found.

Multiple the signe of the Sunnes Meridian altitude for the day proposed, by the whole sign, the product deuide by the signe of the eleuation of the Equinoctiall (or the complement of the latitude) the quotient is the vearsed signe or shaft of the Semidiurnall Arke, which you shall note

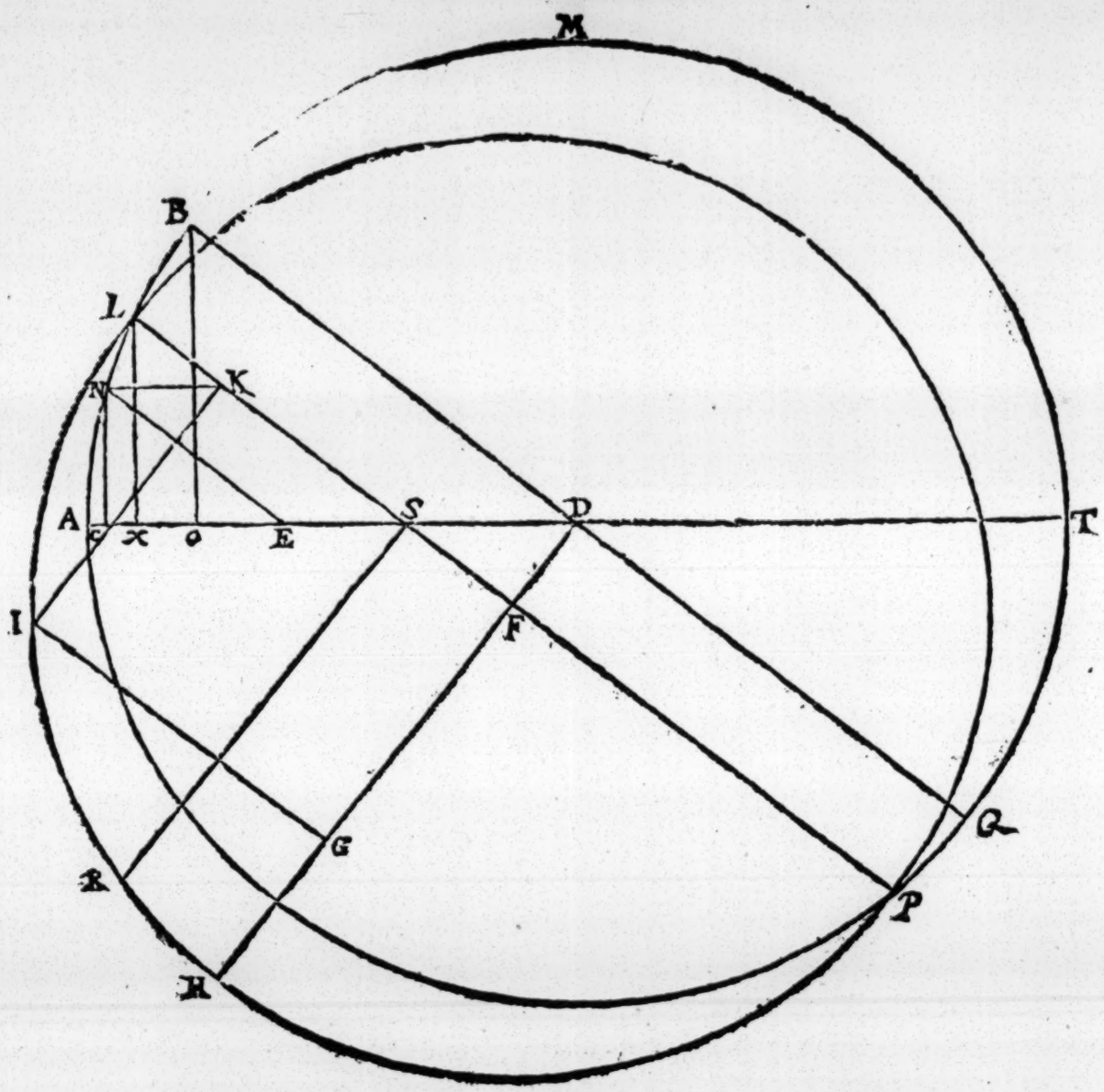
note for the first number.

Then againe multiplie the signe of the Sunnes eleuation at the time of the obseruation, by the whole signe, and the product deuide by the signe of the eleuation of the Equinoctial, the quotient subtract from the number you first noted, the rest is the versed signe of the ark of the distance betweene the Sunne and the Meridian in the paralell that it is in for the time proposed, in such parts as the Semidiameter of the Equinoctiall is the whole signe: but it is necessarie before you applie it anie further, to reduce it into such parts as the Semidiameter of the paralell is the whole signe, which you may doe thus: Multiplie this remainer by the whole signe, the product deuide by the signe of the complement of the declination (which is the Semidiameter of the paralell) the quotient is the versed signe in his proportionall parts.

This versed signe thus reduced and subtracted from the whole signe, leaueth the second right signe, which you shal seeke in the Tables of signes, and thereby finding his arke you shall subtract the same from the Quadrant or 90.d. the remainer is the arke of the forsaid paralell of the Sun, which is answerable or correspondent in degrees and minutes, to the arke of the Equinoctiall that you seeke. The reason of the precept is this.

As the right signe of the eleuation of the Equinoctial, is in proportion to the right signe of the meridian altitude of the Sunne or any Star: so is the whole signe, to the versed signe of the Semidiurnal arke. And again, as the right sign of the meridian altitude, is to the right signe of the eleuation of the sun or star at the time of the obseruation: so is the versed signe of the Semidiurnal arke of the same, to the excesse or difference betweene the same versed signe and the versed signe of the distance from the Miridian.

For the better vnderstanding of the premises, I haue set downe this figure following, and wish the Reader to consider of the same with the 4. Pro. of the 6. of Euclide.



LEt AMT. bee the Meridian circle. BDQ. the common section of the Meridian, and Equinoctiall their plaines, which is also the diameter of both circles.
ADT. the plaine of the Horizon. LHP. the paralell of the Sunne, which is discribed vpon the centre F. at the distance FL. which is the sign of the complement of the declination.
AB. the arke of the eleuation of the Equinoctiall. BO. the first right signe thereof. AL. the arke of the Meridian altitude. LX. the signe thereof. AN. the arke of the Sunnes eleuati-

eleuation at the time of the obſeruation. NC. the ſigne thereof. BD. the whole ſigne in reſpect of the former arkes and ſignes. LR. the Semidiurnall arke of the paralell. RS. the firſt right ſigne therof. SL. the verſed ſigne of the ſame. LI. the ark of the Sunnes diſtance from the Meridian. IK. the firſt right ſigne thereof. IG. the ſecond right ſigne, which is equall to KF. KL. the vearſed ſigne. NE. which is equall to KS. the difference of the two vearſed ſignes. LS. and LK. LF. the whole ſigne in reſpect of the arkes and ſignes of the paralell.

Now as BO. is to LX. ſo is BD. to LS. And as LX. to NC. ſo is LS. to NE. Or elſe thus, as BO. to NC. ſo is BD. to NE.

Example.

The 16. of October. 1580. in Limehouſe.

The eleuation of the Pole Articke 51. d. 32′. The declination of the Sunne. 12. d. 30′. The eleuation of the ſunne obſerued in the forenoone. 17. d. 0′. The variation of the ſhadow vpon the Inſtrument 52. d. 35′. from north to weſt

38. 28′.	90. 0′.	25. 58′.	
BO.	BD.	LX.	LS.
If 62205. giue	100000.	then 43784. giueth	70386.
38. 28′.	90. 0′.	17. 0′.	
BO.	BD.	NC.	NE.
Againe, if 62205. giue	100000.	29237. ſhal giue	47001.

Now out of LS. —— 70386.
take NE. —— 47001.
Reſt LK. — 23385.

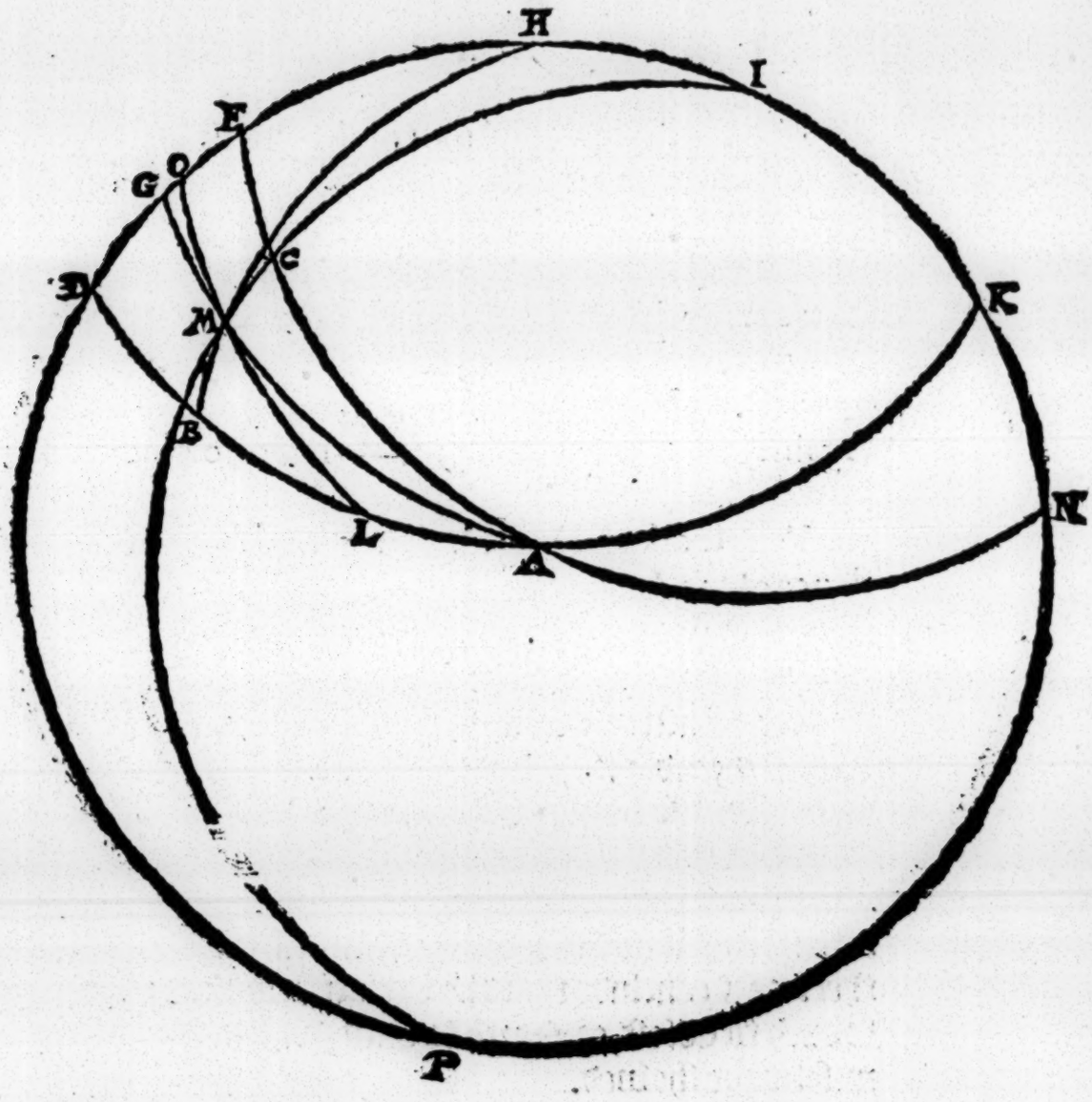
Then if LF. 97629. the ſigne of 77. d. 30′. the complement of the declination, giue LF. 100000. then IK. 23385 giueth LK. 23952. the vearſed ſigne of the Arke IL. in his

due parts. The ſame ſubtracted frō LF. 100000. the whole ſigne, leaueth KF. or IG. 76048. the ſecond right ſigne of the ſame arke, which is the firſt right ſigne of the arke IH. which arke you ſhall finde in the Table of ſignes to be 49. d. 30′. 24″. the complement wherof to the quadrant is 40. d. 29′. 36″. the arke IL. of the paralell betweene the Sunne & the meridian, whoſe coreſpondent arke in the Equinoctiall, is the arke that was ſought.

Now hauing this arke of the Equinoctiall, you muſt worke as followeth.

Multiplie the ſigne thereof, by the ſigne of the complement of the declination, deuide the product by the whole ſigne, the quotient is the ſigne of an arke contained betweene the Sun and the Meridian, making right angles with the Meridian. This ſigne multiplie by the whole ſigne, the product deuide by the ſigne of the complement of the Sunnes eleuation at the time of the obſeruation, the quotient ſhalbe the ſigne of the arke of the Horiſon contained betweene the Azimuth of the Sun and the Meridian, which is the arke that was propoſed to be found.

LEt DHNP. be the Meridian. DAK. the Horizon. EAN. the Equinoctiall. M. the place of the Sun in the heauen at the time of the obſeruation. LMO. the paralell. HMB. the Azimuth or verticall circle paſsing by the Sunne. AMG. a great circle imagined to paſſe by the Sunne, and to croſſe the Meridian at right angles. IMP. a great circle paſsing by the Poles of the world, and place of the Sunne at the time of the obſeruation, commonly called the circle of houres, or circle of declination. CM. the South declination of the ſunne. MP. the complement thereof to the quadrant. MG. the arke betweene the ſunne and the Meridian of the former imagined circle. AMGMO. the Arke of the ſunnes paralell. EC. the coreſpondent arke of the Equinoctiall, which are giuen in the former worke. MB. the Eleuation of the ſunne at the time of the obſeruation.



tion. MH. the complement thereof. BD. the Arke of the Horizon intercepted betweene the Azimuth and the Meridian, vvhiche is the thing required to bee found.

In this figure the Reader is to consider the manner of the spherical triangles, and to comqare the signes of their sides, according to the doctrine of Copernicus, in the 14. Chapter of his first booke, & of Regiomontanus, his 25. and 27. Propositions of his 4. booke of Triangles.

As PC. is to CE. so is PM. to MG. but three of them are giuen,

giuen, therefore the fourth shall be knowen.

And as H M. is to M G. so is HB. to BD. the arke that is sought, which by three first giuen is likewise giuen.

The second part of the example.

90.0′.	40.29′.36″.		77.30′.
PC.	EC.	PM.	MG.
If 100000.	giue 64935.	—then 97629.	giueth 63395.
37.0′.		90.0′	41.31′.22″.
HM.	MG.	HB.	BD.
Againe, if 95630.	giue 63395.	—100000.	giueth 66291.

Whose arke BD. 41.d. 31′.22′. is the Horizontall distance of the Azimuth of the Sun from the Meridian, the thing that was sought.

Now comparing the same with the variation found vpon the Instrument at the instant of 17. d. eleuation, which is 52.d.35′. I finde it to be lesse, and therefore substract it, and so haue I the difference 11.d.3′.38″. And because the obseruation was in the forenoone, and the variation vpon the instrument greater then the arke of the Horizon, betweene the Sunnes Azimuth and the Meridian, therefore I conclude that the variation is 11.d.3′.38″ from South to West, or North to East, which is the thing promised to be shewed.

But comparing the same arke of the Horizon 41.d.31′ 22″. with the variation found at the correspondent eleuation in the afternoone, which is 30.d.0′. I substract the lesser from the greater, & find thereresse 11.d.31′.22″ which should be the variation. And because the variation found vpon the Instrument is lesse then the Arke of the Azimuth vpon the Horizon, I account the variation on the same side of the Meridian, which is from South to West, or North to East.

This variet is betweene the obseruation made in the fore-

forenoone, and that in the afternoone, proceedeth either of the imperfection of the instrument, or negligence of the obseruer. For in the rule there can be no error, beeing grounded vppon Geometricall demonstration, then which, nothing can be more certaine.

The former precepts and examples do serue when the Sunne doth decline from the Equinoctiall either Northwards or Southwards. But if the Sun be in the Equinoctiall, then the manner of the working is more easie and briefe. For if you multiplie the signe of the Sunnes eleuation at the time of obseruation, by the whole signe, and deuide the product by the signe of the eleuation of the Equinoctiall, which is the Meridian altitude, the quotient giueth the second right signe of the distance of the sun from the Meridian, which is the first right signe of the complement of the same arke: And entering the Table of signes with it, you shall finde his arke, which if you subtract from the quadrant or 90. d. leaueth the arke of the distance of the Sun from the Meridian. And hauing the same worke thus. If the signe of the complement of the eleuation of the Sunne at the time of the obseruation, giue the signe of the foresaid arke of distance, what shall the whole signe giue? Multiplie and deuide, the quotient shalbe the signe of the arke of the Horison contained betweene the Azimuth of the Sunne and the Meridian. Which arke beeing compared with the variation of the Instrument in manner as before is shewed, giueth the variation required.

But the Sunne being in the Equinoctiall, if the place where the obseruation is made, be likewise vnder the same circle, then is the variation most easilie obserued, for that the Equinoctiall is the Azimuth of East and West, therefore turning your Instrument onelie to receiue the shadowe of the Sunne, and looking then to the North point of the Needle, if you finde the same to aunswere to the Quadrant or 90. d. you shall bee in the Meridian of the Magnes, which passeth by the Poles of the world, but if it

doe differ from 90. d. the same difference is the variation of the Needle.

But admitting the obseruer to be vnder the Equinoctiall, and the Sunne to haue declination, then the proportion of the signe of the complement of the eleuation at the time of the obseruation, vnto the signe of the declination, shalbe such, as the whole signe, is to the signe of the ark of the Horizon included betweene the Azimuth of East and West, which is the Equinoctiall it selfe, and the Azimuth of the Sun for the time of the obseruation, the complement whereof giueth the true Meridian, which complement you may compare with the variation shewed vpon the instrument, the difference is the variation.

Diuerse other cases might be proposed, and rules giuen for them, which for breuitie I omit.

But one thing I thought good to admonish you by the waie, that whereas I haue shewed in the first part of this proposition, the manner to finde the two vearsed signes, the one of the Semidiurnall arke, the other of the arke of the distance of the Sunne from the Meridian. By the first the Semidiurnal ark being found and reduced into houres and minutes of time, is shewed the iust halfe quantitie of the daie. And by the arke of the other likewise reduced, the houre of the daie, or the time contained betweene the nonestéd and the instant of the obseruation. As in the same example.

The versed signe of the Semidiurnall arke LS. is giuen 70386. in such parts as the semidiameter of the equinoctial BD. is 100000. therefore I reduce ỳ same into such parts as the Semidiameter of the paralel LF. is 100000. and finde it to bæ 72095. which subtracted from the whole signe LF. 100000. there resteth SF. 27905. which is the second right signe of the Semidiurnall Arke LR. and the right signe of RH. 16. d. 12′. which is the complement of the Semidiurnall arke LR. wherefore subtracting it from the Quadrant LH. 90. d. resteth 73. d. 48′.

the

the Semidiurnall arke LR. the same reduced into partes of time alowing 15.d. for an houre 15′. for a minute, & 15″. for a second of time, and for euerie degrée 4. minutes of time, for euerie minute 4″. and for euerie second 4‴. &c. I finde the time of that arke from the point ascendent, to the Meridian, which is halfe the day, to be 4. houres 55′. 12″, and consequentlie the whole day, being the 16. of October aboue written, to be 9. houres 50′. 24″. long.

This example may serue for a general precedent, whiles the Equinoctiall is betwéene the Sunne and the eleuated Pole, but if the Sunne bee betwéene the eleuated Pole, and the Equinoctiall, then will the versed signe fall out to be greater then the whole signe, and the Semidiurnall arke to excéede a Quadrant. Wherefore hauing reduced the same into his proportionall parts, as before is shewed: subtract from it the whole signe, the surplus is the signe of the excesse of the Semidiurnall arke aboue a Quadrant, which being added to the Quadrant, giueth the Semidiurnall arke.

By the other versed signe of the distance of the Sunne from the Meridian, which is LK. 23952. in such partes as the whole signe or Semidiameter LF. is 100000. subtracted from the whole signe, is giuen KF. 76048. the second right signe of the same arke of distance, and the first right signe of 49.d. 30′. 24″. which is the complement of the arke of the Sunnes distance from the Meridian: therefore subtracting the same from 90.d. resteth 40.d. 29′. 36″. the arke of the distance betwéene the Sunne and the Meridian, which being reduced into partes of time as before, giueth 2. houres 41′. 58″. and the same (because it is in the forenoone) deducted from 12. houres the nonestéed, resteth 9. houres 18′. 2″. the iust instant of the time of the daie.

But if this versed signe be found to be greater then the whole signe (as it may when the Sunne is betwéene the Equinoctiall and the eleuated Pole, and before the houre

or sixe in the morning, and after the houre of sixe in the euening) then doth the arke of distance consequentlye exceede a Quadrant, the signe of this excesse is the surplus of the versed signe aboue the whole signe. Whose arke added to the Quadrant, giueth the arke of the Sunnes distaunce from the Meridian, and reducing the same into partes of time, is giuen the instant of time of the obseruation.

As by this meanes (the eleuation of the Sunne beeing precisely obserued and latitude knowen,) the instant of time of the daye is giuen more exactlie, then by anie Clocke, Diall, or other Instrument. So if there might be had a portable Clock that would continue true the space of 40. or 50. houres together (if longer time the better) then might the difference of longitude of anie two places of knowen Latitudes, which conuenientlie maie bee trauailed within that time, be also most exactlie giuen. And in this sort trauailing and obseruing from place to place, might the Longitudes of anie Countrie bee perfectlie described.

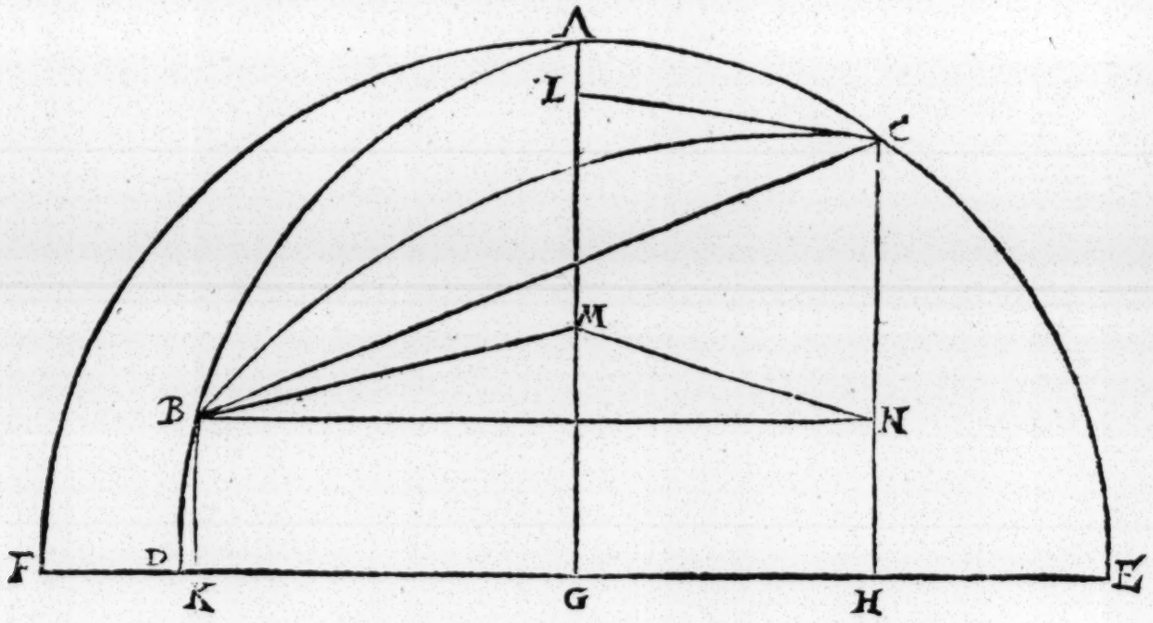
Another waie most generall, how to finde the Variation by one obseruation, either in the forenoone or afternoone, the eleuation of the Pole, and declination of the Sunne being giuen.

The sixt Chapter.

FOr the accomplishing of this proposition you are to imagine a spherical Triangle vpon the superficies of the Globe, whose sides must be. First, the portion or arke of the meridian betweene your Zenith and the Pole, which is the complement of the latitude. The second the arke of the verticall circle contained betweene your Zenith & the sun, which is the complement of the Suns eleuation at the time of the obseruation.

The

The third ſide is an arke of the circle of declination comprehended betweene the Sun and the eleuated Pole, this arke is found by adding, or ſubtracting, the declination of the Sunne, to or from, the Quadrant or 90.d. which muſt be done with this conſideration, that if you be on the ſame ſide of the Equinoctiall that the Sunne is, you are to ſubtract the declination from the Quadrant. If on the other ſide, to add it to the ſame, ſo haue you the three ſides of the ſpherical triangle giuen. Then the ſubſtance of the worke conſiſteth in finding the quantitie of the angle of the ſame triangle at the Zenith, for the complement thereof to the Semicircle or two right Angles, is the Horizontall diſtance of the Sunnes Azimuth from the Meridian, which being compared with the variation of the Sunns ſhadowe vpon the Inſtrument, giueth the thing required.



LEt FACE. be the Meridian, wherein A. the Zenith, C the Pole. AD. the verticall circle of Azimuth of the Sunne paſsing by B. the place of the Sunne at the time of the obſeruation. BD. the elevation of the Sunne. BA. The complement of the eleuation AC. the complement of of the latitude. BC. the arke of the circle of declination, or

the chord of the ſame arke. FGE. the plaine of the Horizon.

Now from the three angles of the triangle ABC. let fal 3. perpendicular lines to the plaine of the Horizon AG CH. and BK. and by the 6. of the 11. of Euclide, theſe three lines ſhall be paralels.

Then let fall a perpendicular line from C. vpon AG. in the point L. from B. another perpendicular vpon the ſame line AG. at the point M. And from the ſame point M. erect a perpendicular line to N. which ſhalbe paralell and equall to LC. Then ioyne B. and N. together. So haue you a right lined triangle. BMN. whoſe angle at M. is equall to the angle A. of the ſpherical triangle ABC. By the 4. definition of the 11. Euclide, for the like reaſon is of obtuſe angles as of acute or ſharpe. And the ſides thereof BM. and MN. are giuen BM. the ſigne of BA. and MN. equall to LC. the ſigne of CA. And the third ſide BN. is found by ſubtracting the ſquare of NC. from the ſquare of the chord BC. as in the 47. of the firſt of Euclide.

And in the right lined Triangles, the three ſides beeing giuen, the angles are alſo giuen, by the 44. 45, &c. of the firſt of Regiomontanus, and by the 7. propoſition of the 13. chapter of Copernicus his firſt booke.

For example I take the former obſeruation of the 16. of October. 1580. and worke as followeth.

The eleuation of the Pole CE. 51.d.32′. the ſigne thereof CH. 78297. The eleuation of the Sunne BD. 17.d.0′. the ſigne thereof BK. 29237. The Arke BC. 102.d.30′. the chord thereof BC. 155970. The complement of the eleuation of the Sunne BA. 73.d.0′. the ſigne thereof BM. 95630. The complement of the Latitude AC. 38.d.28′. the ſigne thereof LC. 62205. equall to MN.

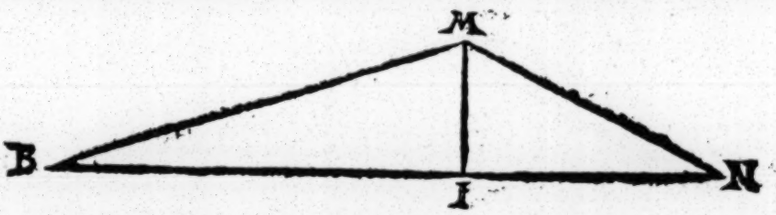
Now

Now out of CH. 78297. ſubtract NH. equall to BK. 29237. Reſt. NC. 49060.

Then out of the chord BC. ſquared.—2432851257 6
Take the ſquare of NC.——————2406883600.

Reſt the ſquare of BN.——————21921628976.
The root therof is 148059. the ſide BN.

So are the three ſides of the triangle giuen. { BN. 148059. MN. 62205. BM. 95630.



Now to find the angle MI. ſubtract from the ſquare of BM. the bigger ſide, which is 9145096900. the ſquare of MN. the leſſer ſide, which is 3869462025. Reſt. 5275634875. which deuided by the baſe BN. 148059, giueth 35631. the halfe thereof 56214. is IN. the leſſer caſe or ſhorter part of the baſe deuided by the perpendicular line MI. falling vpon the ſame from the obtuſe angle M. which ſubtracted from the whole baſe BN. 148059. leaueth IB. 91845. the greater caſe or longer part thereof.

Now it is manifeſt that theſe two caſes or parts of the baſe BI. and IN. are the ſignes of the two ſharpe angles IMB. and NMI. made of the obtuſe angle M. by the perpendicular falling from the ſame angle to the baſe, and the arkes of them ioyned together, are the quantity of the obtuſe angle NMB.

Therefore to reduce them to the numbers of the ſignes, firſt for the greater caſe BI. making BM. the whole ſigne, ſay.

BM.

BM. BM. BI. BI.
If 95630. giue 100000. —then shall 91845. giue 96042

The arke thereof is 73.d.49′.38″. Againe for the lesser case, making MN. the whole signe, saie.

MN. MN. IN. IN.
If 62205. giue 100000. —then 56214. giueth 90376.

Whose arke is 64.d.38′.45″. And adding these two arks together, they giue 138.d.28′.23″. the arke or quantitie of the obtuse angle NMB equall to the spherical angle BAC and deducting it from the Semicircle 180.d. there resteth 41.d.31′.37″. the angle FAD. the Horizontal distance of the Sunnes Azimuth from the Meridian, and subtracting that from 52.d.35. the variation found vpon the instrumēt from North to West in the fornoone, resteth 11.d.3′.23″ the variation of the Needle from the Meridian, the thing that was proposed to be found. And comparing the same with the afternoons obseruation, you shal find it 11.d.31′ 37″. the cause of this difference I haue declared in the former Chapter.

If the Reader be delighted with varietie of demonstration of this matter, let him pervse the 34. Proposition of the 4. of Regiomontanus, and the 13. Proposition of the 14. Chapter of the first booke of Copernicus.

But whereas you see this calculation to differ from the former in some odde seconds, the reason thereof is not as it might be taken the different nature of the rules, but in working thereof, omitting the fractions in the diuisions, and neglecting the proportionall partes of the signes and arkes.

In these examples I haue vsed the abridged table of 100000. the whole signe, which though it giue some ease in the working, yet it is not so exact as that of 10000000. of Erasmus Reinholdus. Vnto the which, with his Canon foecundus answerable to the same, if the third canon of the

Hypo-

Hypothenusaes were annexed, wee should haue an entire Table for the doctrine of triangles, that might worthelie be called the Table of Tables. Which thing though Georgicus Ioachimus Rheticus, haue well begunne and framed it orderly from ten minutes to ten: yet is it left very rawlie, for such as desire the exact truth of things. I haue therfore for mine owne case and vse, calculated the complement of this Table, and almost ended it, for the whole quadrant from minute to minute: which if in the meane time before I haue finished, I shall not find it extant by anie other, I I will publish it for the commoditie of all such as shal haue occasion to vse the same for Nauigation and Cosmographie.

To find the eleuation of the Pole, scituation of the Meridian, and variation of the Needle, at anie place by the Sun, vpon two obseruations, either in forenoone or afternoone.

The seuenth Chapter.

Whereas in the three last Chapters, the grounds of the calculations consist in the eleuation of the Pole to bee giuen, which thing to know is no lesse difficult, thē the chief matter that is by them required: for the common precepts, which as yet haue chiefly bin giuen for the finding thereof, depend only vpon the obseraation of the Meridian altitude of the Sunne or Starres, or else vpon certaine false and grosse rules of the guards and Pole starre. Therefore I haue thought good, that as I haue shewed the waie to know the variation, vppon anie one obseruation, either in forenoone or afternoone, the latitude of the place presupposed: So likewise vpon two obseruations by the Sunne, either in forenoone or afternoone, to set downe the way and manner howe to

finde the eleuation of the Pole, ſcituation of the Meridian, and the variation of the Needle in anie place by the Globe.

But this you muſt alwaies regard, that your two obſeruations may haue conuenient diſtance of time betweén them, the greater the better: So as the higher eleuation be not taken néere the Meridian, the lower eleuation, the néerer it is taken to the Azimuth of Eaſt or Weſt, or to the Horizon the better, with which eleuations you are to note the difference of the Sunnes Azimuths or variations founde by the ſhadowe vppon the Inſtrument exactlie, for without that the eleuations onelie are in vaine.

Firſt it is requiſite that your Globe be ſo fitted, that the meridian circle and the Horizon do croſſe each other at right angles, and deuide themſelues equallie into Semicircles. And alſo that the Quadrant of altitude (or mœueable verticall) be placed dulie vpon the Meridian circle at the Zenith, ſo as being turned circularlie, it may touch the Horizon equallie in euerie part. Theſe things béeing dulie conſidered, there néedeth not anie further regard to be had for placing of the Globe, only this you may reſpect in ſetting the Pole at aduentures aboue the Horizon, betwéene it and the Zenith, that the meridian circle may cut the Horizon in iuſt degrées, ſo may your Quadrant of altitude be placed at your Zenith iuſtly vpon a degrée alſo.

Then muſt you faſten your Globe to the Horizon, ſo as it may remaine immœueable, but in faſtning the ſame you muſt regarde that you force it not from one ſide of the Horizon to another, but that it reſt equidiſtant in the ſame And hauing your Globe thus diſpoſed, it is readie for you to applie your obſeruations vppon, which you ſhall thus doe.

Firſt, take your higheſt eleuation, and note it vpon your Quadrant of altitude, and place the ende of the ſaid Quadrant vpon the Horizon at 10. 15. or 20. d. from the Meridian

dian circle (but the nérer you set the same to the meridian, the more conueniently, without impeachment will your triall be made.) Then giue a pricke vpon the Globe in the Azimuth, that the Quadrant sheweth at the degrée of the eleuation noted vppon the Quadrant, then againe note the lesser eleuation vpon the Quadrant of altitude, and remoue the same vpon the Horizon, (from that place wher it was first fixed, towards the Azimuth of east or West (which shalbe néerest the same) so many degrées as you find the difference of Azimuths betwéene the two eleuations by the shadow of the Sunne, vppon the instrument of Variation, and staying your quadrant of altitude vpon that point of the Horizon: note also your lesser eleuation in the same Azimuth vpon your Globe. Thus done, you must haue a pair of Calliper Compasses, such as may conueniently reach to 113.d. 3. of the Equinoctiall of your Globe, (which is a Quadrant, and the greatest declination of the ☉un) thē you must cōsider which of the Poles of the worlde is eleuated aboue your Horizon, and whether your declination be towards, or from that Pole, that is to say, whether the Sun be betwéene the eleuated Pole, and the Equinoctiall, or the Equinoctial betwéene the Sunne & the Pole. If the sun be betwéene the Pole and the Equinoctiall, then are you to detract the declination from 90.d. If the Equinoctial be betwéene the Sun and the Pole, you must adde the declination to 90.d. And take the same remaining or collected number of degrées &c. with your compasses vpon the Equinoctiall. And set the one end of your compas at the pricke made vpon your Globe, for the highest obseruation, and with the other end describe an arke or péece of a circle, vppon the same side of the meridian that your prick is on, from the Meridian to the Horizon. Then againe with your compas vnaltered, setting the one foot in the prick for the lowest obseruation, describe another péece of a like circle crossing ỹ former. The point of the intersection, or crossing of these 2. circles, is the eleuated pole, to the

which if you remoue the Quadrant of altitude, you shall find what the eleuation thereof is. And the point that the same Quadrant sheweth vpon the Horizon, is the intersection of the Meridian and the Horizon, the Horizontall distaunce betweene this intersection, and the Azimuth of the lesser obseruation, subtracted from the Semicircle, or 180.d. leaueth the Horizontall distance of the same Azimuth from the true Meridian. So haue you the eleuation of the Pole, and scituation of the Meridian.

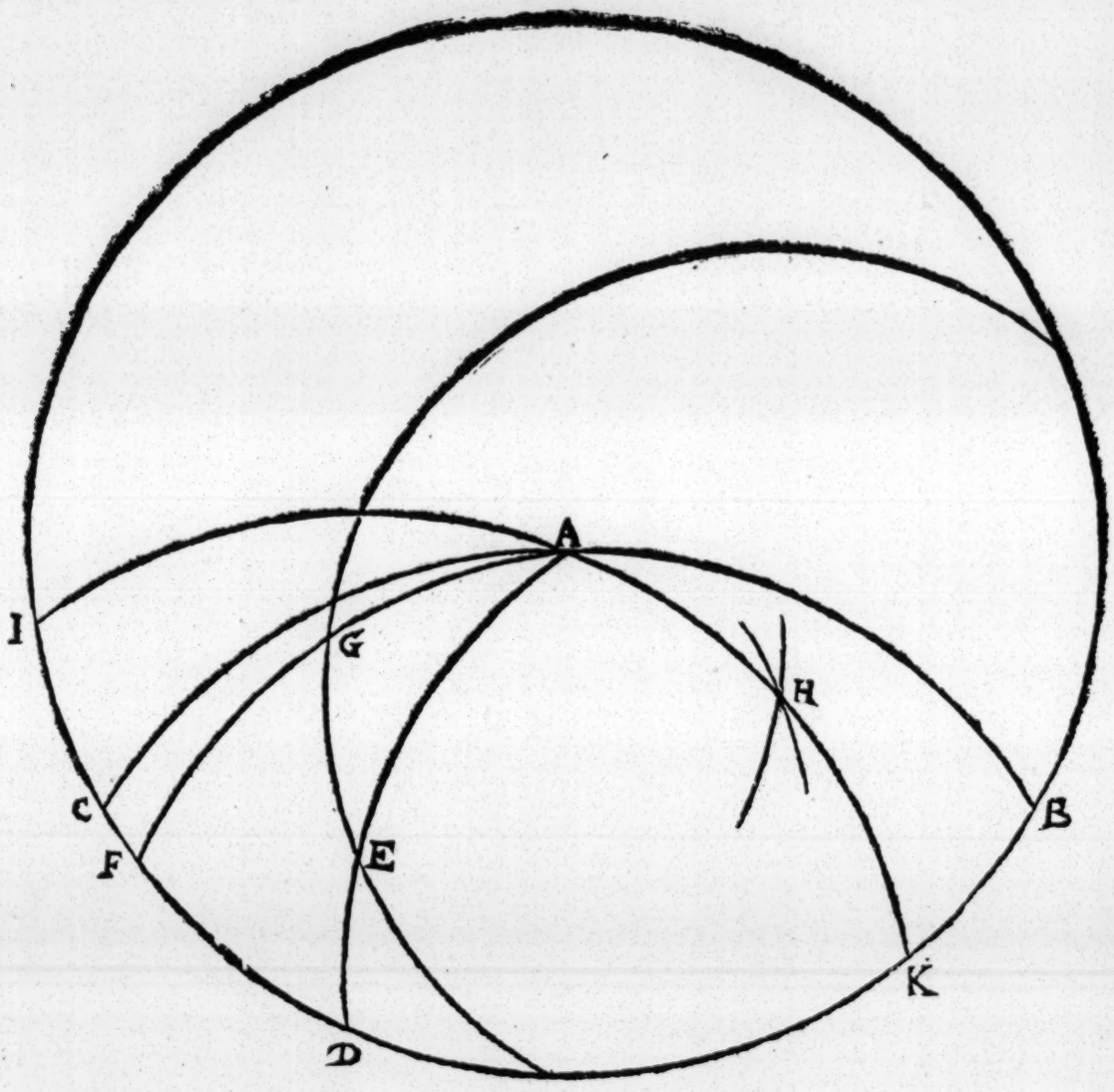
Now if you compare the Horizontall distaunce of the Azimuth of the Sunne, from the Meridian at the time of the obseruation, with the variation by the Suns shadow found vpon the Instrument, at the time of the same obseruation, and taking the one out of the other, the remainer shall be the true variation, which you are to account, as in the latter ende of the third Chapter is shewed. So haue you giuen the eleuation of the Pole, the Meridian, and variation of the Needle, the thinges proposed to bee shewed.

EXAMPLE OF TWO OBSERuations made at Limehouse the 29. of Iulie 1581. in the forenoone.

The first eleuation 21.d.0′. Variation 100.d.30′. from North to West. The second eleuation 50.d.0′. Variation 48.d.0′. from North to West. Difference of the Azimuth 52.d.30′. The Declination 16.d.14′. Northerlie.

LEt IDB. be the Horizon of the Globe. CAB. the Meridian circle. FGA. the Azimuth of the greater eleuation shewed by the Quadrant of altitude vpon the Horizon at F. 10.d. from the Meridian circle of the globe C.FG the greater eleuation marked vppon the Globe at G. FD.

the



the difference of the Azimuths vpon the Horizon. 52.d. 30′.E. the pricke of the lesser eleuation marked vppon the Globe in the Azimuth AED.

Then opening your Compasses to 73.d.46′.of the Equinoctiall (which is the complement of the declination) and setting one end vpon G. the point of the greater eleuation, describe with the other ende, an arke or peece of a circle at H.

This done, set one foot of the Compasse vnaltered in E. the lesser eleuation, and with the other end describe a peece of a circle crossing the former arke at H. this intersecti-

on shall be the eleuated Pole.

Then set the Quadrant of altitude vnto the point H. and it will shew the Meridian to crosse the Horizon at K. So shall you haue the eleuation of the Pole KH. 51. d. $\frac{1}{2}$. or thereabout. And the true Meridian KAI. And from K. to D. the Horizontall distance 90. d. $\frac{1}{2}$. which subtracted from KI. 180. d. the semicircle of the Horizon, resteth the arke DI. 89. d. $\frac{1}{2}$. the distaunce of the Azimuth of the first obseruation from the Meridian I. which distaunce compared with the variation found vppon the Instrument at the first eleuation 100. d. 30′. and deducted from the same resteth 11. d. $\frac{1}{4}$. Therefore I say, the true Meridian shewing the Pole artike is 11. d. $\frac{1}{4}$. to the Westwards of the Magneticall Meridian shewed by the Needle, and consequentlie the variation of the Needle 11. d. $\frac{1}{4}$. from the North to the East.

In this example the declination is subtracted from the Quadrant, because the Sun is betweene the Equinoctiall and the eleuated pole, but if the Equinoctial were betwéen the eleuated Pole and the Sunne, then should you adde the declination to the Quadrant, and with that distaunce taken vppon the Equinoctiall with your compasses, proceéd as in the former example.

These examples that I haue shewed, and such like experimentes to bee done vppon the Globe, are easie to bee conceiued, and the reasons verie manifest: but the trueth of the matter consisteth in the exactnesse of the instrumentes, and the orderlie application and handling of them.

I might héere haue annexed the manner, howe vppon two obseruations of the Sunnes eleuation in forenoone or afternoone, and difference of the Azimuths, to calculate the premises more exactlie by the Table of Signes and doctrine of sphericall Triangles: but that it is a verie tedious waie, and my meaning is rather to giue the Reader a proofe of the pleasaunt vse of these calculations

(which

(which I thinke I haue sufficientlie doone in the former Chapters) then to cloie him at the first with the hard and painfull practise of manie examples. Notwithstanding, for the satisfaction of some, I will briefly set down the ground and summe of the worke, which is this.

The Complements of your two eleuations, are two sides of a spherical triangle not rectangle. The angle betweene these two known sides contained at the Zenith, is giuen by the difference of the Azimuthes or variations vppon the instrument. Wherefore by the 28. of the 4. of Regiomontanus the third side (which is the arke comprehended betweene the two eleuations) and the other angles maie be giuen.

Then haue you another like triangle, whose three sides are these: the first, one of the foresaid complemẽts of eleuation: the second, the arke of the circle of declination, betweene the Sun at the instant of the same eleuation, and the Eleuated Pole. The third side is an arke of the Meridian betweene the Zenith and the Pole: which is the complement of the eleuation of the Pole, or latitude of the place. The two first sides are alwaies giuen. For finding the third side, it is necessarie to knowe the angle that the two giuen sides containe, which is the difference of two angles, whereof one is an angle of the first Triangle giuen, the other an angle contained betweene the arke of the circle of declination, and the third side of the first Triangle, which angle is diuerselye found, and beeing founde and substracted from the other Angle, or that from it, the difference is the Angle of this other Tryangle: And so haue you in the Spheriall Tryangle two sydes, and the Angle by the same two sydes contayned giuen. And by the same 28. of the fourth of Regiomontanus the third side is founde, the complement whereof is the eleuation of the Pole.

And the eleuation of the Pole, and declination of the Sunne

Sun being giuen, the fourth Chapter sheweth by one obseruation, to finde the variation of the Nædle.

Of the Pole of the Magnes.

The eight Chapter.

DIuerse learned men haue iudged, and set down as a truth (grounded vpon report) that the meridian common to the Pole of the world, & the Pole of the Magnes (that is to say, where the Nædle touched with the Magnes, sheweth the Pole of ỹ world directly) passeth at the Ilands of the Acores, or nére there about, (but I find by great probability, that it should be to the Westwards of those Ilands.) From which Meridan at the Acores, I account the beginning of longitudes, and finde our Meridian of London, to be from the same 23.d.½. our Latitude as beforesaid. 51.d.32′. and the variation of the Compas or Nædle, 11.d.¼. from the North to the eastwards. Now vpon these grounds I finde by calculation, the Pole of the Magnes, or the intersectiõ of the two Magneticall meridians, vpon the superficies of the earth, to be from the Pole artik 25.d.44′. and in longitud 180.d. that is to say, 25.d.44′. in the former common meridian, on the other side of the Pole.

It may be happelie that some of you will be desirous to know the way how this Magnetical Pole is found out, that you may applie the same to like purpose hereafter. Therefore I thought good to set downe the manner of the former calculation, by helpe of the declinations in the figure following.

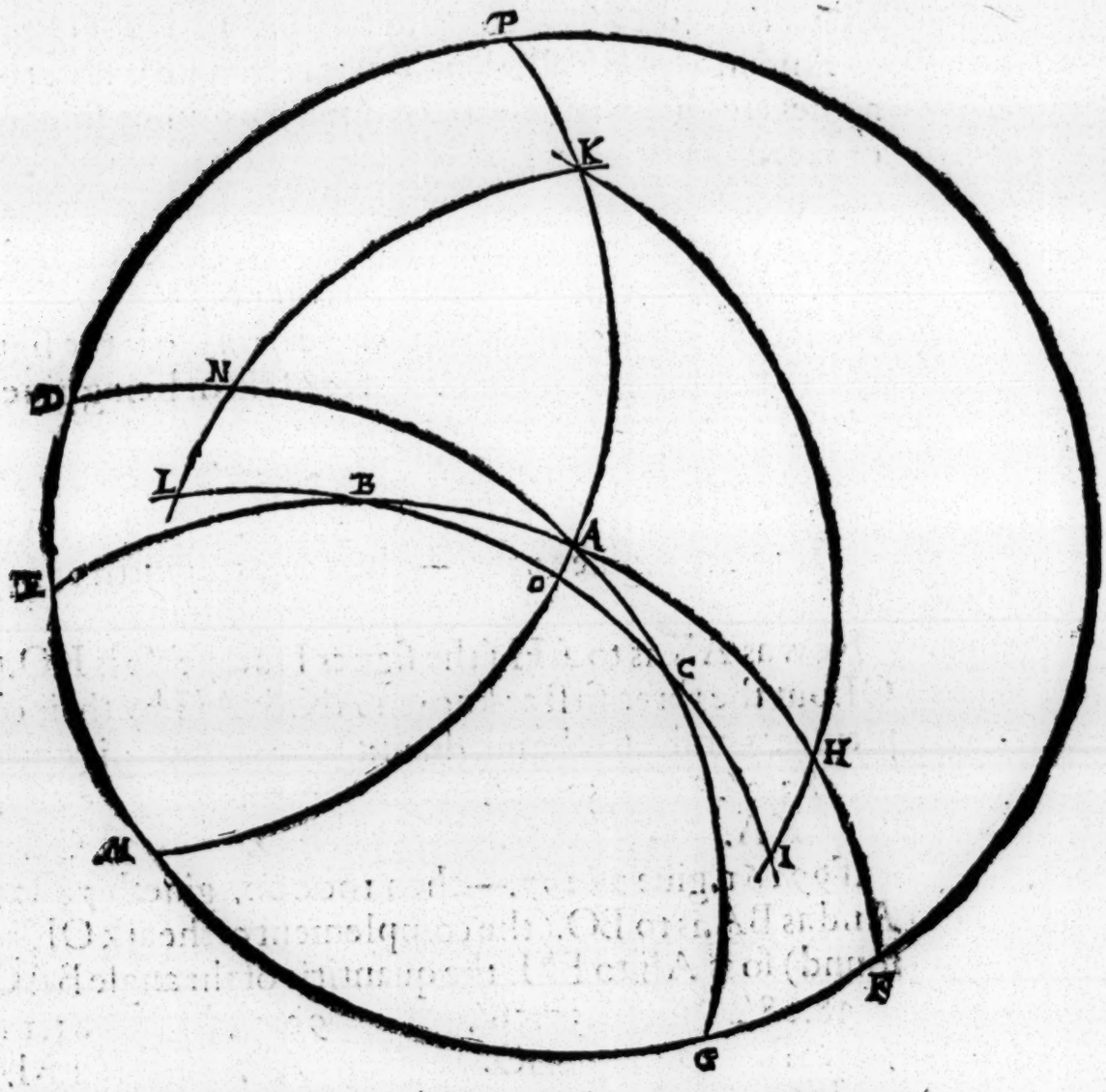
Example.

LEt A. be the Pole Artike. PEF. the Equinoctial. DAG. the common Meridian of the Pole Artik, and Pole of

the

the Magnes. EAF. the Meridian for London.

LOI. the Magneticall meridian of London. B. for the place of London. HI. the quantitie of the angle of Variation at the end of the quadrants BH. and BI. C. the inter-



fection of the two Magnetical meridians. CL. and CN. two quadraunts of the saide Magneticall circles, including the arke LN. the quantitie of the angle at C. PAM. the Semicircle of a Meridian crosing the Magneticall Meridian of London in the point O. at right angles.

Make out the quadrants IHK. and LNK. so shall they crosse themselues with the quadrant OAK. at the point K

Now haue you ABC. a ſpherical triangle, two angles whereof, and the common containing ſide of them, are giuen. ABC. 11.d.½ the angle of Variation at London. BAC. 156.d.30′. the complement of the angle DAE (the difference of the longitudes) to 2. right angles. And the ſide AB. 38.d.28′. the cõplemẽt of the latitude of Londõ.

And in a ſpherical triangle, not rectangle, whoſe two angles are giuen, and their common containing ſide, the other angle and ſides ſhall be knowen, by the 31. of the 4 of Regiomontanus.

Wherfore the arke AC. the diſtance of the two Poles ſhall be giuen, which is the thing required.

For as the ſigne of BH. is to the ſigne of HI. ſo is the ſigne of BA. to the ſigne of AO. & three of them being giuen, the 4. is found.

90.0′.	11.15′.	38.28′.	6.58′
BH.	HI.	BA.	AO.

If 100000. giue 19509.—then 62205. giueth 12135.

Now as AK. is to AH. (the ſignes I meane) ſo is KO. to OI. but the three firſt ar known AK. & AH. by their cõplements, and KO. the quadrant: therefore the 4. is giuen.

83.2′.	51.32′.	90.0′.	52.4′.
KA.	AH.	KO.	OI.

If 99261. giue 78297.—then 100000. giueth 78879.

And as BA. is to BO. (the complement of the ark OI. laſt found) ſo is AE. to EM. the quantitie of the angle BAO.

38.28′.	37.56′.	90.0′.	81.12′.
AB.	BO.	AE.	EM.

If 62205. giue 61474.—then 100000. giueth 98824

So hauing EM. 81.d.12′. the quantity of the angle BAO I ſubſtract the ſame from EG. 156.d.30′. the quantity of the whole angle BAC. reſt MG. 75.d.18′ the quantity of the angle CAO. to the which is equal the oppoſite angle PAD. And as AP. is to PD. ſo is AK. to KN.

90.0′.	75.18′.	3.2′.	73.46.
AP.	PD.	AK.	KN

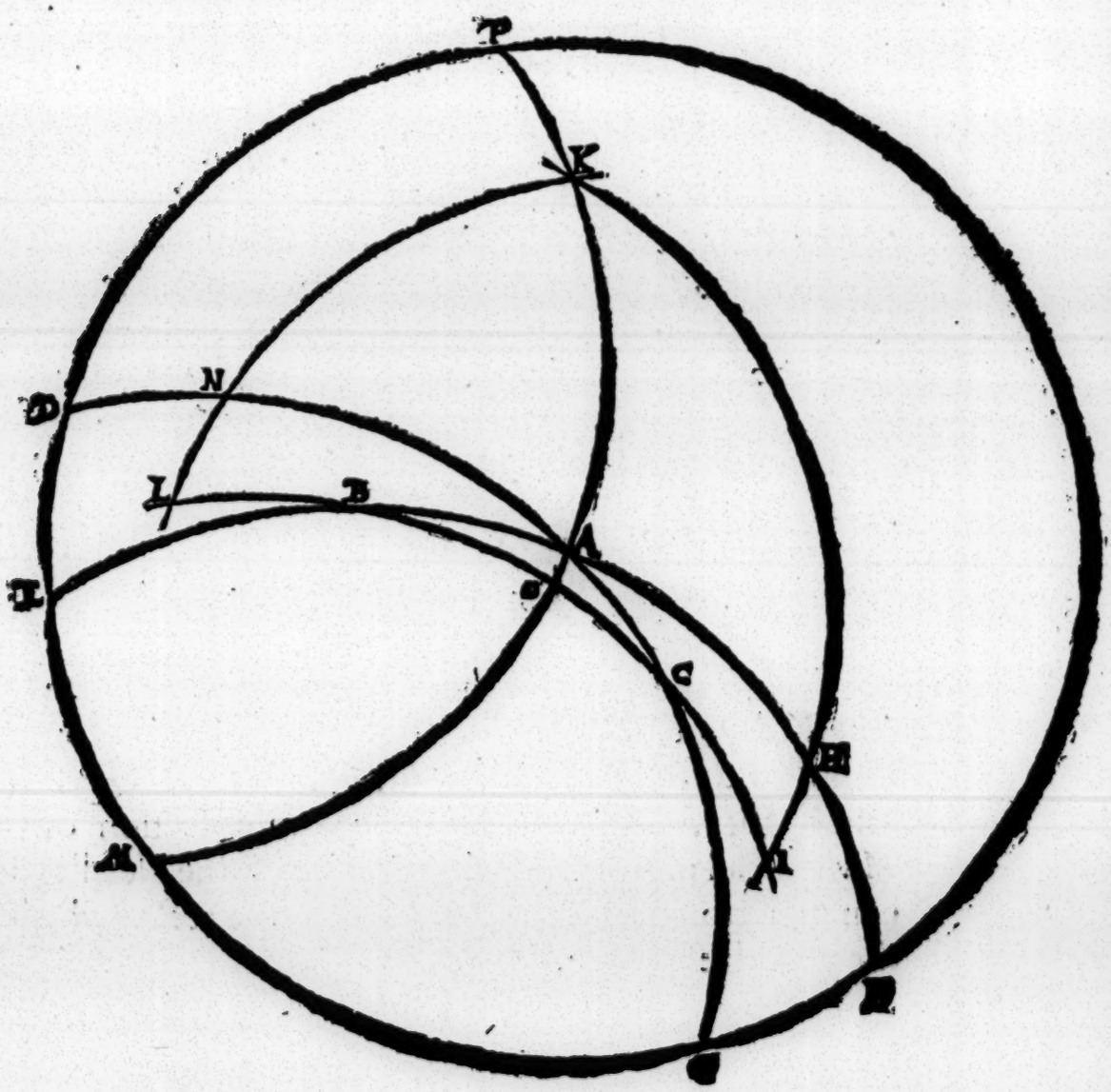
If 100000. giue 96726.—then 99261. giueth 96011′

The complement of which arke KN. is NL. 16. d. 14′ the quantitie of the angle ABC. And as NL. is to NC. ſo is AO. to AC. Whereiore I ſay.

16.14′.	658′..	25.44′.	
NL.	NC.	AO.	AC.

If 27954. giue 100000.—then 12135. giueth 43410.

Which is the diſtance of the Pole of the Magnes from the Pole artike vpon the former Hypotheſis, the thing that was ſought.



Of the point Respectiue.

The ninth Chapter.

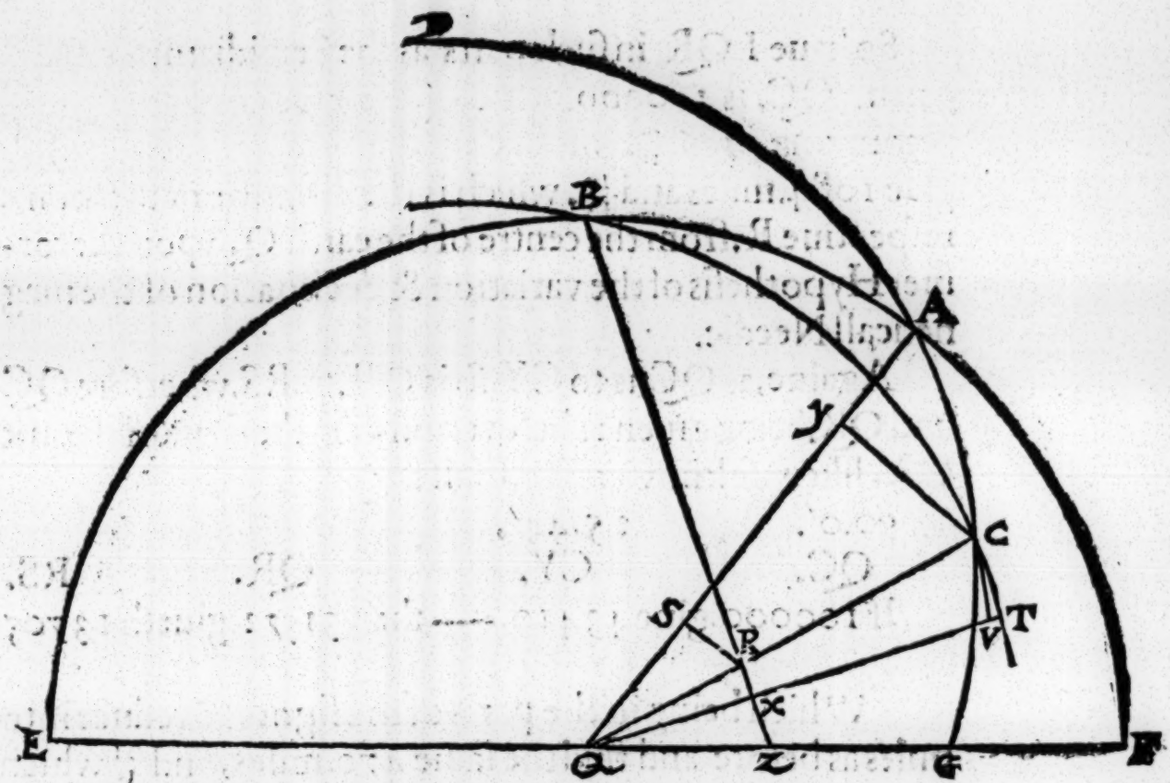
HAuing shewed in the former Chapter, vpon the groundes therein specified, the place of the Pole of the Magnes, vpon the superficies of the earth: there resteth now to be declared of the point respectiue, wher it should be, by the new propertie found of the declining of the Needle, beeing at this place for London, 71.d 50'. as in the former treatise by R. Norman.

First it is to be considered, that as the Magnetical meridians do crosse themselues at their Pole before specified: so doe their plaines likewise crosse in a right line, passing by the said Pole, and the centre of the earth. Then producing a straight line in the Magneticall plaine of London, declining from the plaine of the Horizon 71.d.50.'. where the same doth crosse with the former common section of the two plaines, there by reason should the point Respectiue bee. Which intersection I find to be from the centre of the earth. 1685. miles (after the rate of 60. to a degree in the equator, and 3436.′. for the Semidiameter of the Earth) and the distance of the same from the axis of the worlde. 471. miles.

For Example.

LEt the citeles be as in the last demonstration, then shal BC. be the distance of the Pole of the Magnes from the Zenith B. And Q. the centre of the earth. QA. the axis of the worlde. QC. the common section of the Magneticall plaines. BZ. the line of the Needles declination crosing the said common section at R. (which is the point Respectiue.) QT. a straight line crosing BZ. at

right



right angles in X. QR. the distance of the point Respectiue from the centre of the earth. RS. the distance thereof from the axis. First it is requisite to know the quantitie of the arke BC. which is thus found, as the signe of the angle ABC. 11. d. 15'. hath vnto the signe of the arke AC. 25. d. 44'. So hath the signe of the angle BAC. 156. d. 30'. (which is allone with the signe of the angle BAD. the difference of Longitude 23. d. 30'.) to the signe of the arke BC which is 62. d. 46'. Now as QV. is to QC. so is QX. to QR But the three first are knowen QV. the second right signe of the arke CT. 9. d. 4'. (the difference of the arke BT. 71 d. 50'. And BC. 62. d. 46.) Then QC. the semidiameter or whole signe, and QX. the second right signe of the arke BV. Wherefore QR. shall be giuen by the 4. of the sixt of Euclide.

80.46'. 90.0'. 18.16'.

QV. QC. QX. QR

If

If 98.750. giue 100000.——then 31178. giueth 31572.

So haue I. QR. in ſuch parts as the Semidiameter of the earth. QC. is 100000. which (being reduced into miles, accounting 3436. $\frac{4}{11}$. for the Semidiameter of the earth) do giue 1084. miles and $\frac{10}{11}$. which is the diſtance of the point reſpectiue R. from the centre of the earth Q. vpon the former Hypotheſis of the variation & declination of the magnetical Needle.

Againe, as QC. is to CY. ſo is QR. to RS. wherfore QC and QR. being giuen as before, and CY. the ſigne of the ark CA. likewiſe knowen. RS. ſhall be giuen.

90.0′. 25.44′.

QC. CY. QR. RS.

If 100000. giue 43410.——then 31572. giueth 13705

Which being in the parts of the ſignes, I reduce into miles as before and find the ſame 470. miles, and $\frac{01}{11}$ which is the diſtance of the point reſpectiue R. from the axis of the world QA. By the former Hypotheſis.

The tenth Chapter.

Of the application of the Variation, to the vſe of Nauigation.

Vpon the Hypotheſis of ỳ pole of the Magnes on the ſuperficies of the Earth, & the point Reſpectiue in the body thereof, according to the former calculations, might be inferred many pleaſaunt concluſions, both for the longitude & latitude of places.

But as touching the point Reſpectiue by the declining of the Needle, ſeeing this is the firſt and onely experiment that hath beene made of it, I cannot inferre anie further matter thereof, then that which I haue alreadie ſet down, vntill by obſeruations in other places, wee finde howe it will holde.

And

And as for the variation, if it were generallie regular and certaine, as in ſome part it ſeemeth to bee: (that is to ſaie, from hence Weſtwardes to Meta Incognita, Newe-found-land, Florida, and that part of the coaſt of America) then might there be giuen by it generall rules, commodious for the vſe of Nauigation

And by the ſame Hypotheſis of the Pole of the Magnes at 25.44′. from the Pole of the worlde, the greateſt variation of the Néedle in the Equinoctiall, ſhould bee (at 90.d. of Longitude) 25.44′. from North to Eaſt, and conſequentlie the greateſt variation in the Paralell of 70.d. ſhould be (at the Longitude of 128.d.51′,) from North to Eaſt 81.d.14′. And in the Meridian of 180.d. of longitude, betweene the two Poles (the Pole Articke I meane) & the ſuppoſed Pole of the Magnes, there ſhould the North point of the néedle or compas reſpecting his owne Pole, ſhew the South, & the South point the North Pole of the world.

But in my trauailes to the Northeaſt parts, I haue found this poſition of the Magneticall Pole cleane reuerſed: for where as the angle of Variation from hence Eaſtwards in the Paralell of 70.d. ſhould encrraſe and growe wider, till it came to 81.d.14′. from North to Eaſt as before. At the Iland Vaigats being in longitude from London. 58.d. and in the ſame Paralel of 70.d. where, by the former Hypotheſis, the variation ſhould be 49.d.22′ from North to Eaſt. I finde the Néedle to varie 7. degrées from North to Weſt. And the like effect I haue found by diuers obſeruations in ſundrie other places of the Eaſt partes. Which obſeruations with many more that I haue cauſed to be made, and daily procure to bee done in diuerſe other Countries, I reſerue, with intent (if it be poſſible) to find ſome Hypotheſis for the ſaluing of this apparant confuſed irregularitie.

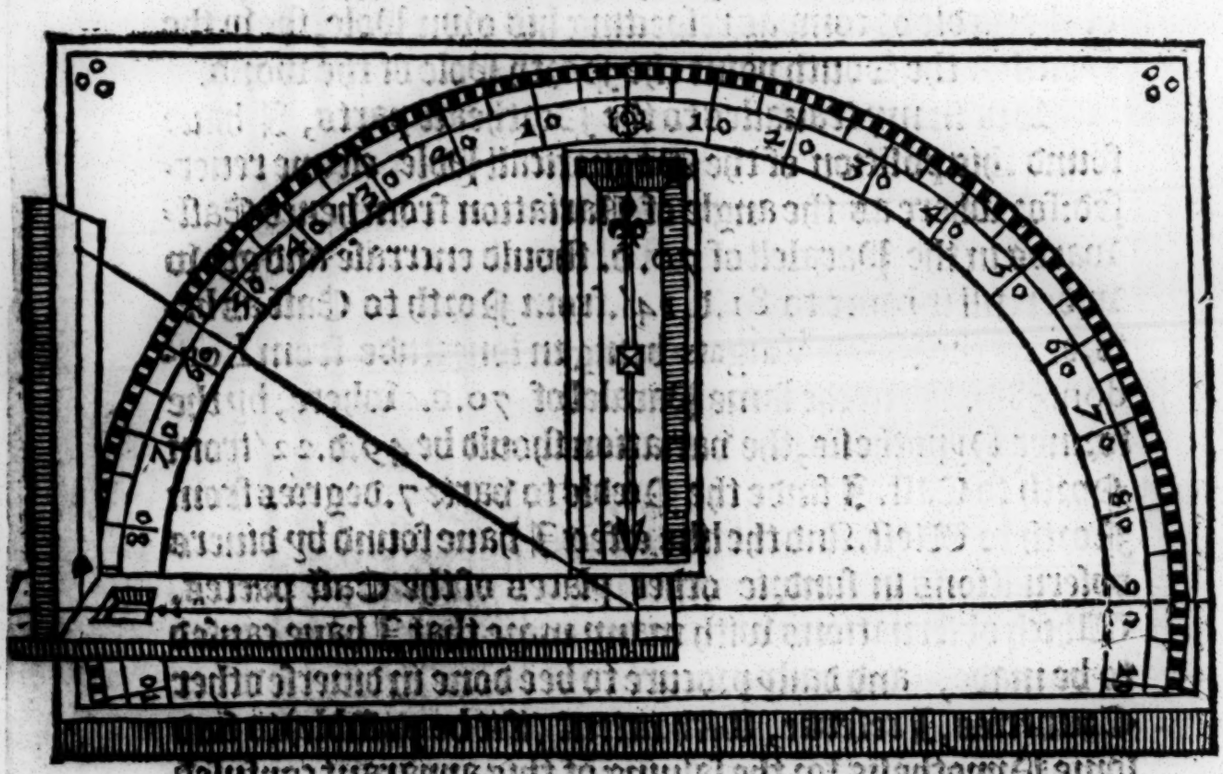
At Ratisbona or Regensburg in Bauaria, being in latitude 48.d.52′. and in longitude 36.d.20′. where, by the former poſition of the Magneticall Pole at 25.d. 44′. the

Varia-

Variation should be 16.d.44′. from North to East. Gerardus Mercator found the same to be onelie 11. ¼ as I gather by his placing of the Magneticall Pole at 16. d. 22′. from the Pole Artike, vpon his obseruation made at that place: which confirmeth the retrograde qualitie in the variation from hence Eastwards, as afore said.

Which strange varietie, I haue heere plainly proposed, to the end that the learned sort might consider therof, and sharpning their wits, see what probable causes & grounds they can assigne for the same. For considering it remayneth alwaies constant without alteration in euery seueral place, there is hope it may be reduced into method & rule.

A new Instrument for the Variation.



BEcause I haue found some imperfections in the first Instrument for the variation, which notwithstanding doth far excell the compasses of variation heretofore vsed for that purpose) I haue heere set down the forme of a new

Instrument

Inſtrument, wherein all ſcruple of doubts and defects that might growe by other is quite auoyded. Which beeing once exactlie placed with the Needle vpon the line of ſouth and North, will ſerue without remouing for a whole daies obſeruation, the Inder onelie beeing carried about with the Sunne, to giue the degrees of Azimuth vpon the Inſtrument by the ſhadowe of the line thereof, and is otherwiſe to bee vſed according to the prescript rules of the former Inſtrument.

Of the inconueniences and defectes in ſailing, and in deſcription of Countries, cauſed by the variation of the Compaſſe.

The eleuenth Chapter.

IN all Sea Chartes generallie, which are made without conſideration of the variation, are committed great errors and confuſion. For, either the parts therein contained, are framed to agree in their latitudes by the ſkale thereof, & wrested from the true courſes that one place beareth from another by the Compaſſe, or elſe in ſetting the partes to agree in their due courſes, they haue placed them in falſe latitudes, or abridged, or ouerſtretched the true diſtaunces betweene them.

In the Marine Plats made for Newfoundland, the courſe ſet downe from Sillie to Cape Raſo is due Weſt, which is found to be ſo by our common ſailing Compaſſe, whoſe wiers are ſet ½. a point from North to Eaſt, notwithſtanding Sillie beeing in latitude 50. d. little more. Cape Raſo in Newfoundland is found to bee but in 46. d. ⅓ which is 3. d. ⅔. leſſe then the latitude of Sillie.

To make a ſhew of reformation of this error, (cauſed by the Variation and ſetting of the wiers in the Compaſſe) or to giue a light of that difference in Latitude, they

haue placed in the plat against that coast, a newe scale of Latitude, some vpon the line of South and North, and some other haue placed the saue vppon the line of North Northeast, and South Southwest (because that point of the Compasse sheweth the Pole nerest in that place) and haue furnished the degrees thereof agreeable to the Latitude of Cape Raso: and by that meanes haue had a double scale of latitude, one for the Easter coasts, the other for that West. But how farre the same hath bene from reforming the errour, or giuing anie helpe to Nauigation, you may easilie iudge.

Others, to auoide that errour of the difference in latitude in that voyage and course, haue vsed Compasses, whose wiers haue beene set directlie vnder the North point, and thereby sailing West from Sillie, haue fallen to the Northwards of Cape Raso about 50. leagues, and in latitude nere 49. d.

Some other haue vsed in the same voyage to place a blanke Flie vpon their sailing compasse, which they haue remoued from time to time, as they haue iudged the variation hath altered, by which way, albeit they may seeme to keepe themselues nerer the Paralell, yet the same in Nauigation worketh the greatest confusion of all other, and therefore is to be vtterlie abolished.

In our voyages from hence Eastwards to S. Nicholas in Russia, and to the Narue in Liuonia, &c. The Marine Plats of the coasts are described by our common Sailing Compasse, with consideration of the variations at diuers places, whereby the true meridians reformedly set down, declining from the Paralell Meridians of the Plat, doe necessarilie widen Northwardes, and straighten to the Southwardes, contrarie to the true forme and nature of Meridians. And yet notwithstanding, that is the best meanes hitherto knowen, to reforme in Plat, the errours that else would growe by the straunge variations that waie.

And

And albeit these places serue verie well for those Nauigations, yet by meanes of the variations considered, the forme of those Coastes is so distorted from the right shape it should beare, beeing truelie described vppon the globe or otherwise in plaine, according to the true latitude and longitude: That whereas the Narue (beeing in Latitude 59.d.¼. and in longitude from the Meridian of London 26.d.10′.) should be from S. Nicholas 9.d.40′. in longitude to the Westwardes (S. Nicholas beeing in latitude 64.d.35′. and in longitude from London 35.d.50′.) In the sailing Plat it is brought to be in the Meridian of Colmogorod, (which is in latitude 94.d.20′. and in longitude from London 37.d.45′) which is 1.d.55. to the eastwards of the Meridian of S. Nicholas.

In the Mediterranean Sea, and in the Coasts thereof, wher, in great reason should be the perfectest descriptions of the worlde, for that in those parts haue bene the seates and abodes of the most famous and learned men in all ages, wee see not withstanding in the Marine Plats of those partes, grose errours committied, through want of knowledge of the variation, and the vse thereof, in which they haue not accounted of 3.4. or 5. degrees errour in the latitude of places.

But those defects of the latitudes haue bene verie wel reformed, by the famous and learned Gerardus Mercator (whom I honor and estéeme as the chiefe Cosmographer of this time) in his vniuersall Map, which though he haue made with sailing lines, & dedicated to the vse of Seamen, yet for want of consideration of the variation, the same is more fit for such to behold, as study in Cosmographie, by reading authors vppon the land, then to be vsed in Nauigation at the Sea.

There is also in the same vniuersall Mappe, and likewise in all other moderne Maps of the North parts of Europe, a great fault, by placing two Wardhouses distaunt one from the other aboue 20. d. in longitude, whereas

in deede they are but one thing, and no such distaunce betweene them. This errour hath growen by taking Wardhouse, and the Sea coasts, from thence to S. Nicholas Vaigats, and the Ob &c. out of the Map of that worthy trauailer, M. Anthonie Ienkinsons his iourney to Boghar & Persia, &c. In the which I placed that border of the Sea coast, and for some causes went no further Westwardes in that description, then Wardhouse, which is in latitude 70.d. ½ and in longitude from London 29.d. Wherefore to accomplish the whole border of that coast, hee was forced to seeke some other description to ioyne with it, and toke as appeareth the Map of Olaus Magnus of the north Countries, wherein hee found likewise Wardhouse, but falselie placed, in latitude about 19.d. too much, & in longitude as much too little, the which, although he might take to be the same specified in Maister Ienkinsons Map, yet hee was constrained to seperate them the said distaunce of 20. d. in longitude (or to leaue there so much superfluous rome) otherwise he should haue thrust the South partes of those Countries togethers, and confounded the whole description.

And albeit he had had the entire sailing Plat, that wee vse for those parts, yet if hee had not knowen the secret effect of the Variation in the making thereof, he might haue fallen into the like absurditie or worse. But of those coasts and of the inward partes of the Countries, Russia, Muscouia, &c. I haue made a perfect Plat and description, by mine owne experience in sundrie voyages and trauailes, both by Sea and Land, to and fro in those parts, which I gaue to her Maiestie in Anno 1578.

Besides these and like imperfections proceeding of the Variation, there is yet another inconuenience, which oftentimes encreaseth the former errours, and that is, the diuerse placing of the viers, fixed to the Flie of the Compasse.

This varietie of setting the viers, hath caused great confu-

confusion in Nauigation, and in other accountes of Sea causes: for when it is said, that from such a head land, to such a place, is such a course, or at such a place the Moone vpon such a point of the Compasse maketh the full Sea, it is requisite to bee demaunded, by what Compasse the obseruation was made, whereas if the wiers had not bene altered from the North point of the Flie, (which I wish had neuer bene any where) these doubts had béene auoyded.

It behoueth therefore all men that will make Hydrographicall descriptions for the vse of sailing, to haue speciall regarde of the Compasse by which these obseruations are made, and if they collect notes made by sundrie Compasses of diuerse settes, they ought to reduce all the varieties vnto some one certaine, and to giue notice of the same in their Plat: And not to make a confused mingle mangle by ioyning togeather all varieties of obseruations, notes, and reports, as the Portingales and Spaniards haue done, in compounding these North partes of the worlde, with their owne discoueries, without consideration of the diuerse sortes of the seuerall Compasses by which they were made.

Also it importeth all Maisters, Pilots, and others by what name so euer, that shall giue directions in Nauigation, to loke circumspectlie to the setting of the wiers of the Compasse by which they shall saile, that the same Compasse be correspondent, to the lines of the Sea Carde that they shall vse: that is to say, that it bée of the same set for the Variation, that the compasse was of, by which the Card was made.

And seeing wée haue in this our Countrey, acquainted our selues commonlie in our obseruations and Nauigations, with the Compasse, whose wiers are set at ½ a point from North to East, I meane in the descriptions that I shall make to applie the same agréeable to the said Compasse, and would vse the like without alteration (and al-

so the straight lines in Sea Cardes) if I should sail round about the worlde to make the description thereof, but alway with regard of the seueral variations of euery place, where the same should be obserued.

Of the Instruments and rules in Nauigation.

The twelfe Chapter.

AMongest the rules and Instruments for Nauigation, all such are vaine & to small purpose, wherin the true Meridian is presupposed to be giuen by the Magneticall Needle, without due consideration of the variation, for that they are all grounded vpon false suppositions. Hereby it commeth to passe that one Michael Coignet of Antwerp, in his New instruction (as hee tearmeth it) of the most excellent and necessarie points of Nauigation, wherin he sheweth the making and vse of a Nauticall Hemisphere, which he preferreth before all other Sea Instruments, is verie childishly abused. For whereas he pretendeth by it, to giue the eleuation of the Pole, and the houre and instant of the time of the date, by anie one obseruation in anie place: besides that, it is of all other that hath hetherto beene vsed at Sea, the most tedious and vnfit for that purpose: it is also by reason of the variation not considered, meere false and erroni-ous. For the true Meridian (which is the ground of his purpose, is as farre to seeke as the thing hee promiseth to giue by the same. The like may be said of all other Instruments made vppon the same ground, whether they serue for the Sea or land.

The same author in the 4. Chapter of his booke, entreating of sailing vpon the poinctes of the Cumpasse, saith, that in sailing South or North he shall passe by the poles of

of the world, and kéepe vnder one Meridian, till he come to the place from whence he first departed. And vpon the points of East and West out of the Equinoctiall, hee shall saile vnder a Paralell, till hee returne to the place from whence he went. But in sailing vpon the point of North-East, he shall describe a spirall line inclining by little and little towards the Pole, as in his demonstration thereof in the same Chapter appeareth. But for want of due consideration of the variation, his rules, reasons, and demonstrations, and such others hitherto giuen for like purposes are friuolous and false.

For if he direct his sailing by the Compasse (as of necessitie he must, being the onelie Instrument for that purpose) it is manifest, that whether he saile North or South, East or West, or by what other point so euer, the Compasse not respecting alwayes the Pole of the world, as he supposeth, but some other point or points distant from the same, shall leade aim accordinglie, whereby hée shall neither kéepe vnder one Meridian, nor vnder one paralell of latitude, neither make such a spirall line to the Pole of the world, as he demonstrateth. His fault in setting downe those rules is so much the greater, in that he acknowledgeth in the Chapter next before the variation at Antwerpe, to be about 9. d. from North to East according to Mercators position, of the Magnetical Pole, which he also confirmeth by his owne experience.

But it séemeth he hath followed that excellent Mathematrian petrus Nonius, especially concerning the sailing vpon the points of East and West. For he, in his first booke of the rules and Instrumentes of Nauigation, enforceth himselfe to proue and demonstrate, that in sailing East or West out of the Equinoctiall, the course is performed by péeces of great circles, and yet describeth a Paralell. But how that may stand with the principles of Geometrie, I referre the iudgement to the expert Mathematicians, for it is like as a circle shoulde bee

made

made of straight lines, which is impossible.

It appeareth in the discourse that hee hath made of those matters, that hee had not a right iudgement of the nature of the Compasse in sailing (admitting the same to shew the Pole without Variation) for if he had, he would neuer haue entered in such a Labyrinth as he did. But hée thought it a great absurditie that the Compasse in euerie Horizon, should shew the Meridian & Poles of the worlde by the points of North and South, and by the points of East and West, to shew in the Horizon the verticall and Equinoctiall. East and West, (béeing a great circle) and yet in sailing East or West, except in the Equinoctiall, it should performe but a paralell.

But it is to be vnderstode, that albeit the points or lines of the Compasse do alwaies in euerie Horizon represent great circles in the Heauens, the pointes of South and North the Meridian, and the points of East and west the verticall circle of East and West, each crossing other at right angles, and likewise of the pointes. (The reason whereof is, because the Compasse lieth euery where leuell with the Horizon, so as a perpendicall line descending from the centre thereof at right angles with the plaine of the same, will alwaies fall vppon the centre of the earth, and consequentlie be the Semidiameter of a great circle) So that whersoeuer the Compasse be caried, these circles are supposed to bee carried about with it, and the viewe of euerie thing in the Horizon, represented by the poinctes thereof, is likewise in great circles: Yet in sailing by the Compasse, the points of South and North onely, describe great circles generallie, which are the Meridians, and the pointes of East and West, describe a great circle in the Equinoctiall onelie: in all other places out of the Equinoctiall, they describe but Parallels. And the sailing vppon anie other point of the Compasse from anie place, describeth a spirall line, according to the angle it maketh with the Meridian. And héereby in sailing vppon the

points

points of East or West, out of the Equinoctial, (the north point alwaies respecting the Pole) the course perfourmeth a Paralell, according to the distaunce of the centre of the Compasse from the Pole. The manner thereof you may perceiue by fastning a small thrid or Virginall wier at the Pole of a Globe, or centre of a circle, which shall represent a moueable Meridian to be carried about the globe or circle, and fire vpon the same, a small Flie of a Compasse, so as the line of South and North be answerable to the thrid or wier, and the North point thereby alwaies respect the North Pole: then in turning the thrid about the Globe or circle, vpon the Pole or centre, if the center of the Flie bée out of the Equinoctiall, (betwéene it and the Pole) albeit the points of East and West, crossing the same line and moueable Meridian at right angles, doe shewe thē verticall East and West vppon the Globe, which is a great circle, yet in carrying the same Flie vpon the thrid or moueable Meridian about the Pole or center, you shall by the centre of the same Flie describe but a Paralell, according to the distaunce thereof from the Pole of the Globe, or centre of the circle, not vnlike the circular motion of a horse drawing in a Mill, who though he loke forth streight in a right line, yet beeing fastned to the beame of the Mill, is forced to make his course in a circle, whose Semidiameter is the length of the beam contained betwéene the horse and the centre of the mill or milpost.

And as in the Equinoctiall, the line of South and North in the Compasse (by supposition representing the Meridian) is paralell to the Axis of the earth, (which is the common section of all the Meridian plaines,) and the line of East and West, crossing the same Axis of right angles, representeth the verticall East and West, which is the Equinoctiall, imagining to discend from the centre of the Compasse a line, to fall perpendicularlie, and at right angles with the Axis of the world (which shall be at the centre of the earth) and in sailing East or West by the Com-

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passe, the imagined perpendicular line, being caried about with the same (making alwaies right angles with the axis) shall describe the plaine of the Equinoctiall, Equidistant from the Poles of the worlde, and at right angles with the Axis: and the point of the same line at the centre of the Compasse, the circumference of the Equinoctiall, vpon the superficies of the Sea: So being from the Equinoctiall on either side, imagining the line of South and North in your Compasse, to represent alwaies the Axis of the worlde, and to lie Paralell with it, the line of East and West must crosse the same Axis alwaies at right angles: And supposing a line to fall from the centre of your Compasse to the Axis of the worlde, making right angles with the same Axis. In sailing East or West, that imagined line beeing carried about with the Compasse (alwaies at right angles with the Axis) shall describe the plaine of a paralell, equidistant to the plaine of the Equinoctiall, and the point thereof at the centre of the Compasse, the circumference of the paralell vpon the superficies of the Sea: which Paralell should be represented by the points of East & west of the Compasse, if the line of south and North of the same, were Paralell to the Axis of the Poles, as was supposed, but it is not. And therefore, as they decline one from ỹ other, so doth the verticall circle of East and West shewed by the Compasse, decline from the paralell circle euerie where.

The angle of which declination is alwaies equall to the latitude of the place, or distaunce of the Paralell from the Equinoctiall.

But as I haue already sufficientlie declared, the Compasse sheweth not alwaies the Pole of the world, but varieth from the same diuerslie, and in sailing describeth circles accordingly. Which thing, if Petrus Nonius and the rest that haue written of Nauigation, had ioyntly considered in the tractation of their rules and Instrumentes, then might they haue beene more availeable to the vse of

Naui-

Nauigation, but they perceiuing the difficultie of the thing, and that if they had dealt therewith, it would haue vtterlie ouer-whelmed their former plaucible conceites, with Pedro de Medina (who as it appeareth hauing some small ſuſpicion of the matter, reaſoneth very clarkly, that it is not neceſſarie that ſuch an abſurditie as the variation, ſhould be admitted in ſuch an excellent Art as Nauigation is) they haue all thought beſt to paſſe it ouer with ſilence. But I hope ſuch as intend hereafter to write of Nauigation, will either frame their rules, precepts, and inſtruments, with regard of the Variation, as herein I haue ſhewed, or elſe eaſe themſelues of that trauaile, for as good none, as vnprofitable.

FINIS.